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## Low-Income Countries Are Most Responsive to Income and Food Price Changes

Recent commodity price spikes have put the spotlight on households' food budgets worldwide. Consumers in low-income countries, such as the Democratic Republic of Congo and Ethiopia, are more sensitive to changes in income and food prices than their counterparts in higher income, developed countries like the U.S., Canada, and Germany. As they react to income and price changes, consumers in low-income countries respond with larger adjustments to their food consumption patterns. These adjustments are not uniform across food categories—consumption of higher value food items, such as meats and dairy products, changes more than that of staple foods, which include wheat and rice.

In a recent study, ERS and collaborating economists from other institutions estimated elasticities for nine broad consumption categories (food, clothing, education, housing, house furnishings, medical, transport and communication, recreation, and other) and eight food subcategories (cereals, meat, fish, dairy products, oils and fats, fruit and vegetables, other foods, and beverages and tobacco) for 144 countries. The data used in the study are from the World Bank's 2005 International Comparison Program (ICP), covering 146 countries (the ERS analysis omits Greece and Comoros due to data

issues), updating previous results based on the 1996 ICP covering 115 countries.

Advances in ICP data collection since 1996 led to more accurate measures of expenditures, prices, and gross domestic product (GDP) and, consequently, to more accurate estimates of income and price elasticities. The 2005 ICP data, which are the most recent available, account for more than 95 percent of the world's population and 98 percent of the world's nominal GDP. Among the newly added countries in the 2005 ICP are many low-income countries in Africa (now 48, up from 22), as well as China and India.

The *income elasticity* measures the estimated percentage change in quantity demanded for a particular consumption category if income (taken here as total expenditures on all categories) increases by 1 percent. In general, income elasticities for food are highest among low-income countries, averaging 0.78 percent, compared with an average of 0.50 percent for high-income countries. In other words, consumers in low-income countries will spend a larger share of an increase in income on food than consumers in high-income countries. These findings are in accordance with Engel's law in that as income rises, the proportion of income spent on food falls.

These new measures are higher than those based on the 1996 ICP data, especially for the group of high-income countries. Restaurant and catering expenditures are newly included in the 2005 ICP data, raising the income elasticity for food. Cereals and vegetable oils and fats are among the most essential purchases for households in low-income countries. Income elasticities for both food groups average above 0.5 for low-income countries and under 0.1 for high-income countries.  $\mathcal{W}$

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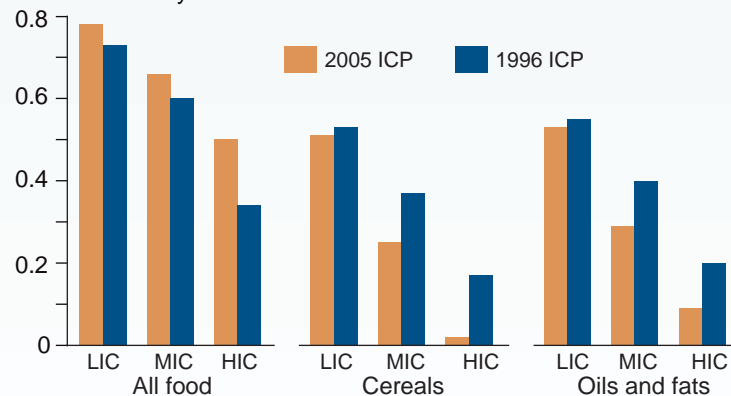
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**This article is drawn from . . .**

*International Evidence on Food Consumption Patterns: An Update Using 2005 International Comparison Program Data*, by Andrew Muhammad, James L. Seale, Jr., Birgit Meade, and Anita Regmi, TB-1929, USDA, Economic Research Service, March 2011, available at: [www.ers.usda.gov/publications/tb1929/](http://www.ers.usda.gov/publications/tb1929/)

### Consumer spending in low-income countries is more responsive to changes in income

Income elasticity



ICP = International Comparison Program, a World Bank program covering 146 countries. LIC = Lower income countries. MIC = Middle income countries. HIC = High income countries.

Source: USDA, Economic Research Service analysis of International Comparison Program data, World Bank.



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## Beef and Pork Byproducts: Enhancing the U.S. Meat Industry's Bottom Line



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Beef and pork production yields more than just what is seen on people's plates. Byproducts—edible offal, inedible offal, blood, hides, and rendered products—include virtually all parts of the live animal that are not part of the dressed carcass. These items constitute an estimated 30 percent of the liveweight of a hog and about 44 percent of the liveweight of cattle. A myriad of uses for these items—leather products from hides; lubricants; plastics; soaps; glycerin; gelatins; and other industrial, household, cosmetic, pharmaceutical, and medical supplies—allow the meat industry to capture additional revenue and avoid costs for disposing of certain edible and nonedible parts of the animal.

Exports and other markets for animal byproducts contribute to the value and profitability of the meat processing industry and

mean higher livestock prices. ERS research indicates that a \$1 increase in the value of byproducts to processors adds about 10 cents to the average price paid per hundredweight to producers of fed steers (slaughter cattle that have been finished on concentrated feed on a per hundredweight basis). Conversely, consumer prices for other beef products are lower than they would be without byproduct sales because the processing costs to wholesalers of the entire animal are spread across both byproducts and meat.

In the U.S., edible offal (animal organs such as liver, heart, and stomach) is used to produce sausages, hot dogs, and other processed meat products; it is also a major ingredient in pet foods. In foreign markets, demand for U.S. edible offal, including variety meats (edible byproducts that are segregated, chilled, and processed under

sanitary conditions and are inspected for sanitation and wholesomeness by the U.S. Meat Inspection Service), is high because of its superior quality and low prices relative to domestic products. Over the past 10 years, byproducts accounted for more than 35 percent (volume) of U.S. beef and veal exports and 23 percent (volume) of U.S. pork exports. Together, edible beef/veal and pork byproduct exports account for more than 16 percent of the value of total U.S. beef/veal and pork exports. In 2010, beef/veal and pork edible offal exports reached a record level of \$1.2 billion, \$135 million more than the previous record set in 2009.  $\mathbb{W}$

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### This finding is drawn from . . .

"U.S. Variety Meat Exports and the Global Marketplace," by Daniel L. Marti and Rachel J. Johnson, in *Livestock, Dairy, and Poultry Outlook*, LDP-M-195, USDA, Economic Research Service, September 2010, available at: [www.ers.usda.gov/publications/ldp/2010/09Sep/ldpm195.pdf](http://www.ers.usda.gov/publications/ldp/2010/09Sep/ldpm195.pdf)

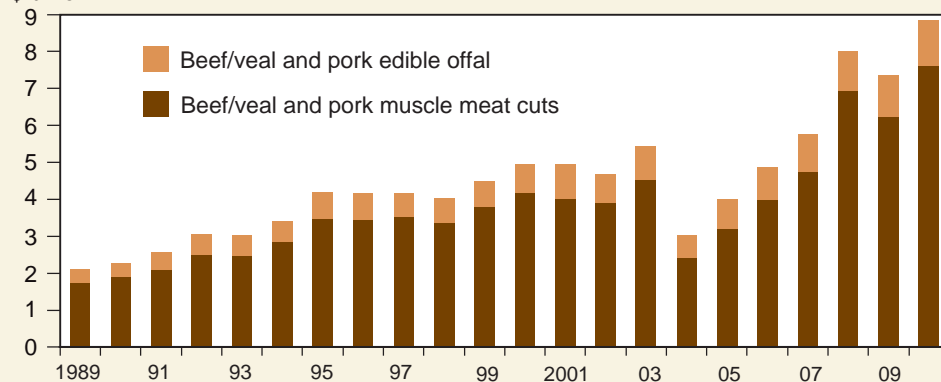
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### In 2010, U.S. exports of beef/veal and pork edible offal reached a record \$1.2 billion

\$ billion



Source: USDA, Economic Research Service using USDA, Foreign Agricultural Service, Global Agricultural Trade System data.



## Consumers Cut Back on Convenience But Not Necessarily Quantity When Incomes Fall



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During a recession, consumers tend to reduce expenditures, including food spending. In the 2007-09 recession, inflation-adjusted spending on food declined as consumers curbed their eating out and economized in the grocery store (see “Food Spending Adjustments During Recessionary Times” on page 10 of this issue).

Exactly which foods or food characteristics consumers cut back on has ramifications for their health and for the food industry. ERS researchers have found that convenience is one food characteristic for which recession-constrained consumers will reduce expenditures. Specifically, in one recent study, researchers found that sales of bagged leafy greens decreased relative to sales of unpackaged leafy greens when income levels fell.

The U.S. leafy green market provides a good example of the tradeoff between convenience and price. The marketing of vegetables has undergone radical changes in the past 20 years with the introduction of packaged, prewashed vegetables sold in either bags or plastic containers. The con-

venience to consumers of prepackaged vegetables, particularly leafy greens, includes time savings from not having to sort, wash, dry, or chop. These time savings come at a price. Packaged vegetables typically cost more than their conventional counterparts. For example, in 2006, washed packaged leaf and baby spinach cost \$3.32 per pound, while loose or bunched random-weight spinach sold for \$1.05 per pound. Despite these higher prices, prepared and ready-to-eat bagged leafy green products, including salad mixes, accounted for more than half of all retail leafy green purchases in 2009.

To look at the effect of changing income levels on leafy green purchases, ERS researchers analyzed monthly disposable personal income and monthly retail purchases of bunches of spinach, heads of various types of lettuce, and bagged leafy greens in 2004-09. They found that changes in the level of disposable personal income have an almost immediate impact on the share of bagged leafy greens. Specifically, a 1-percent increase in income typically leads to a 1.2-percent increase in bagged leafy greens’ share of total leafy green purchases, and an

income decrease leads to a similar decline in the bagged share. This suggests that a sustained rise in income would slowly continue the trend toward greater reliance on more convenient produce products. Conversely, a sustained recession would dampen or reverse the trend.

Interestingly, the researchers did not find evidence that shortrun changes in disposable personal income influence the overall quantity of leafy greens purchased. The same results were observed after adjusting the purchased quantities to ensure that all items were measured according to the same consumable weight basis. These findings show that consumers, in regard to leafy greens, sacrifice convenience before quantity in balancing food budgets. *W*

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### This finding is drawn from . . .

“Is it Food Quality or Quantity that Responds to Changing Income?” by Fred Kuchler, in *Applied Economic Perspectives and Policy*, 2011, Vol. 33, No. 2, pp. 205-221.



## New Loss Estimates Suggest Higher Vegetable and Protein Consumption

Each year, ERS estimates the amount of food available for consumption in the U.S. By summing production, beginning stocks, and imports, and subtracting exports, ending stocks, and nonfood uses, ERS calculates the total supply of hundreds of foods. But supply or availability does not equate to consumption. Bones, peels, and other inedible parts are discarded, spoilage losses occur throughout the marketing system, and not everything on the dinner plate makes it into our stomachs. From kids feeding vegetables to the dog to family members refusing to eat leftovers *again*, not all the food we buy or prepare is actually consumed.

ERS researchers recognize this discrepancy and adjust the Food Availability data for nonedible parts and food losses from farm to retail, at retail, and at the consumer level. Good information exists to adjust for nonedible shares and losses at the retail level, but consumer-level food loss is not as well documented. These losses vary greatly depending on a food's perishability, how it is used (as an ingredient or eaten as is), and whether it is typically consumed by children or adults.

ERS contracted with the research organization RTI International to develop updated consumer-level loss estimates. RTI researchers compared purchase data from Nielsen Homescan and

Perishables Group, Inc., with consumption data from the National Health and Nutrition Examination Survey (NHANES) to estimate annual consumer-level losses for approximately 200 foods.

For some foods, the new RTI estimates and the original ERS loss estimates are similar. For example, ERS assumed 13 percent of provolone cheese is lost annually at the consumer level, while the RTI estimate is 14 percent. RTI loss estimates for fresh pumpkin, Swiss cheese, and lard are much higher than those previously used by ERS, while RTI estimates for chicken, lamb, and frozen potatoes are lower. These differences could stem from changes in food demand and preparation habits or simply from different measurement techniques.

If all of RTI's food loss estimates are adopted, changes to ERS's current Loss-Adjusted Food Availability data would vary for individual foods. Changes over entire food groups, however, would be small. The most affected group would be meat, poultry, fish, eggs, and nuts. Using RTI estimates would increase annual food availability for this group by 22.6 pounds per person, or 14.7 percent. Grain and grain products would have the smallest change—a decrease of 2.1 pounds per person, or 1.5 percent.

Overall, using RTI's proposed estimates would reduce estimated total per capita availability by 10.1 pounds of food per year, or roughly 28 fewer calories per day, for the average American. ERS plans to use many of the RTI loss estimates in its loss-adjusted data series. **W**

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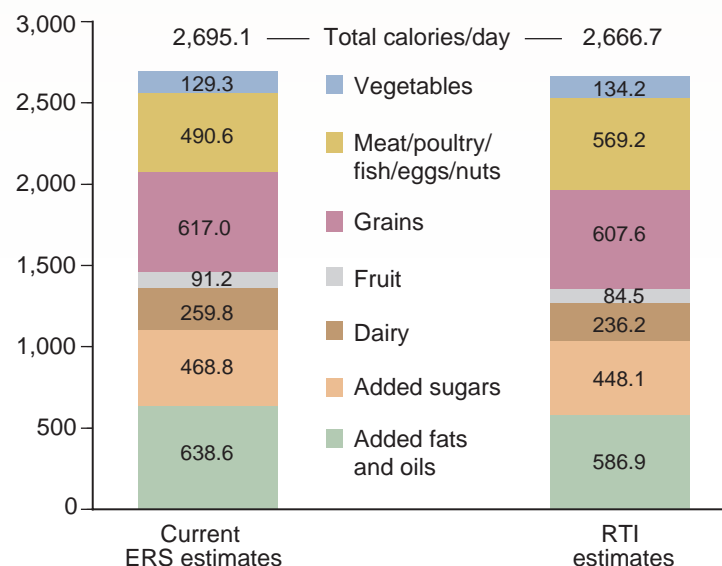
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**This finding is drawn from . . .**

*Consumer-Level Food Loss Estimates and Their Use in the ERS Loss-Adjusted Food Availability Data*, by M.K. Muth, S.A. Karns, S.J. Nielsen, J.C. Buzby, and H.F. Wells, TB-1927, USDA, Economic Research Service, January 2010, available at: [www.ers.usda.gov/publications/tb1927/](http://www.ers.usda.gov/publications/tb1927/)

### Using RTI International's new food loss estimates would slightly reduce calorie availability

Daily calories available, 2006



Source: USDA, Economic Research Service.

## Buying Power of WIC Fruit and Vegetable Voucher Varies Across the Country

Findings from a 2011 ERS study show that due to geographical food-price variation, the new fruit and vegetable voucher for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) buys substantially smaller amounts in some U.S. areas than in others. In 2009, the WIC program began providing cash vouchers for fruit and vegetables. WIC mothers now receive a \$10 voucher each month (WIC children get a \$6 voucher) to purchase any fruit and vegetables, except white potatoes. The other WIC benefits are quantity vouchers for a specified amount of nutritious foods, such as a dozen eggs or 1 to 2 pounds of whole wheat bread.

Using Nielsen Homescan data from 2004-06, ERS researchers examined average prices of 20 frequently purchased fruit and vegetables in 26 metropolitan markets. Average prices were calculated based on the dollar amounts spent on different forms of fruit and vegetables (fresh, canned, and frozen) purchased from all stores across all households and then averaged over the 3 years. For compari-

**WIC participants in markets with higher prices in 2004-06 could not buy as much fruit and vegetables as in lower priced markets**

Select vegetables & fruit	National average prices	Amount purchased with \$10 voucher		
		National average	Market with minimum price	Market with maximum price
	<i>Dollars per pound</i>	<i>Pounds</i>		
Broccoli	1.34	7.5	9.1	6.2
Carrots	1.18	8.5	10.1	7.3
Green beans	0.96	10.4	16.8	7.6
Lettuce	1.01	9.9	11.2	8.6
Tomatoes	1.66	6.0	7.0	5.1
Apples	1.10	9.1	10.3	8.1
Bananas	0.49	20.4	25.1	16.2
Oranges	0.85	11.8	13.9	8.0
Peaches	1.13	8.9	10.5	7.1
Watermelon	0.87	11.5	20.2	8.4

Source: USDA, Economic Research Service using 2004-06 Nielsen Homescan data.

son, researchers also calculated a single national average price for each fruit and vegetable. To account for the small sample size in some cities, the original 52 Nielsen market areas were consolidated into 26 metro markets based on geography and other market characteristics.

Individual fruit and vegetable prices were 30 to 70 percent higher in the most expensive markets versus the lowest priced metro markets. For example, tomatoes, the most popular vegetable, averaged \$1.66 a pound nationwide but were least expensive in the Nashville/Birmingham/Memphis/Louisville market group at \$1.42. In contrast, tomatoes were the most expensive in San Francisco at \$1.98 per pound. A WIC mother living in Nashville would have been able to purchase 7.0 pounds of tomatoes with her \$10 voucher but only 5.1 pounds in San Francisco.

Oranges—another favorite—had a price spread of 73 percent and cost \$0.85 per pound, on average. Oranges were least expensive in the Kansas City/Minneapolis/St. Louis/Des Moines/Omaha market group at \$0.72 per pound, and they were most expensive in the Hartford/New Haven market group at \$1.25. A WIC mother would have been able to buy 13.9 pounds of oranges with her \$10 voucher in Kansas City and only 8.0 pounds in Hartford.  $\mathbb{W}$

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**This finding is drawn from . . .**

*The WIC Fruit and Vegetable Cash Voucher: Does Regional Price Variation Affect Buying Power?* by Ephraim Leibtag and Aylin Kumcu, EIB-75, USDA, Economic Research Service, May 2011, available at: [www.ers.usda.gov/publications/eib75/](http://www.ers.usda.gov/publications/eib75/)





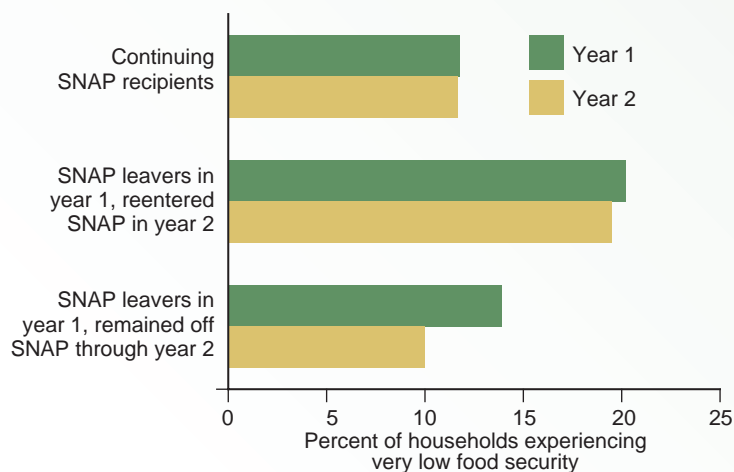
## Some Households No Longer Eligible for SNAP Have Unmet Food Needs

SNAP (the Supplemental Nutrition Assistance Program, formerly the Food Stamp Program) provides resources to help eligible low-income families obtain nutritious food. Very low food security—characterized by disrupted eating patterns and reduced intake—is more prevalent among households that recently left SNAP than among households still receiving assistance.

A recent study by ERS researchers examined the economic conditions of households that had recently left SNAP to find out why households with unmet food needs leave the program. Data from households interviewed in 2 consecutive years of the 2002-07 Current Population Survey Food Security Supplements provided a longer term view of the food security situations of households after they left SNAP. Households that participated in SNAP sometime in the first year of a 2-year period, but not in the final 30 days of that year, were classified as “SNAP leavers.”

Two distinct groups of SNAP leavers were identified. The first group, about one-third of those that left in the first year, returned to SNAP in the second year. Shortly after leaving SNAP, these households had a higher prevalence of very low food security (20.2 percent) than continuing participants (11.8 percent). Even after returning to SNAP in the second year, they continued to have higher rates of very low food security (19.5 percent) than those that never left.

### Very low food security in year 1 was more prevalent among recent SNAP leavers than among continuing SNAP recipients



Source: USDA, Economic Research Service using 2002-07 Current Population Survey Food Security Supplement data.



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The second group left SNAP in the first year and remained off the program throughout the second year. These households also had a higher prevalence of very low food security (13.9 percent) after recently leaving SNAP than those that remained on SNAP. However, by the end of the second year, very low food security among households that remained off SNAP throughout the second year declined (10.0 percent) and was somewhat less prevalent than among continuing recipients (11.7 percent).

ERS researchers then investigated why households that were not fully food secure left SNAP and found that those that left had better employment and higher incomes than households that remained on SNAP. Most of the households that left SNAP apparently did so because they were no longer eligible for SNAP or were eligible for only relatively small benefits based on their income levels. Even though recent SNAP leavers were generally better off economically than continuing recipients, recent leavers were still more likely than continuing recipients to face very low food security in the first year after leaving SNAP.

The findings suggest that the period of transitioning off the program can be a financially challenging time for some households despite their improved economic circumstances. More research is needed to understand what happens to households as they transition off the program.

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### This finding is drawn from ...

“Food Insecurity After Leaving SNAP,” by Mark Nord and Alisha Coleman-Jensen, in the *Journal of Hunger & Environmental Nutrition*, 2010, Vol. 5, No. 4, pp. 434-453.



## Organic and Conventional Apple Orchards Differ in Pest Management But Share Other Attributes

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Sales of U.S. organic produce are forecast to reach over \$10 billion in 2011, according to industry estimates, capping over a decade of double-digit annual increases. Apples are among the top organic produce items, and U.S. apple growers and distributors have responded vigorously to the fast-growing demand for organically grown products. Certified organic apple acreage nearly doubled between 1997 and 2008 and accounted for about 6 percent of all U.S. land in apple production in 2008 (see chart on page 59). In addition, major apple exporters, including Canada, Chile, and Argentina, are now marketing organic as well as conventional apples within the United States.

In 2007, as part of its annual Agricultural Resource Management Survey (ARMS), USDA conducted the first comprehensive survey

of the production and marketing practices used by organic and conventional apple growers. The survey results indicate that organic and conventional apple growers make many similar production and marketing decisions, including the predominance of dwarf and semi-dwarf trees, average tree density, and a focus on the fresh consumption market. Approximately 72 percent of conventional and 82 percent of organic apples were sold for fresh consumption in 2007, with the rest used to make juice, applesauce, pies, canned fruit, and other apple products.

Both organic and conventional producers used a variety of pest management practices to prevent, monitor, and suppress pests. ARMS data showed that conventional producers relied mostly on synthetic pesticides and chemical fertilizers for pest and nutrient management in 2007, while organic producers used biological pesticides, compost, and other materials that are on USDA's list of approved substances. Most synthetic materials are prohibited in organic farming.

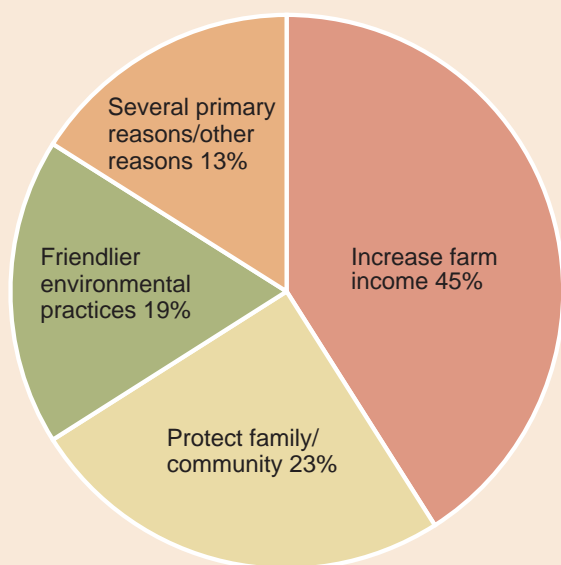
Growers indicated a variety of reasons for choosing to farm organically in 2007, including prospects for increased farm income. Conventional apple yields were higher than organic yields in 2007. However, organic apples—whether for fresh consumption or processing—commanded substantial price premiums. Grower prices for organic apples were more than double conventional prices for fresh apples and nearly double conventional prices for processing apples.  $\mathcal{W}$

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### This finding is drawn from . . .

*Characteristics of Conventional and Organic Apple Production in the United States*, by Edward Slattery, Michael Livingston, Catherine Greene, and Karen Klonsky, FTS-347-01, USDA, Economic Research Service, July 2011, available at: [www.ers.usda.gov/publications/fts/2011/07jul/fts34701/](http://www.ers.usda.gov/publications/fts/2011/07jul/fts34701/)

### Higher farm income was the primary reason growers opted for organic apple production in 2007



Source: USDA, Economic Research Service using data from USDA's Agricultural Resource Management Survey.

## Tax-Deferred Exchanges of Farmland Provide Valuable Savings to Some Farmers

A tax-deferred exchange permits taxpayers to delay paying capital gains taxes on the disposition of property traded for “like-kind” property. Known as “1031-exchanges” after the section of the Internal Revenue Code permitting their use, the exchanges offer landowners tax advantages over traditional land sales. By allowing farmland owners to defer payment of taxes on capital gains—which can be significant on land that has been owned for many years—farmers who sell land and use the proceeds to purchase other property can often increase their net worth, reduce borrowing costs, and expand the size of their operations (see chart on pg. 59).

However, concern has been raised, particularly among beginning farmers, that like-kind exchanges may be contributing to the rapid growth in farmland values because of the law’s strict time limits for completing such exchanges. Under the law, a replacement property must be identified within 45 days of a land sale, and the exchange must be completed within 180 days, encouraging those involved in like-kind exchanges to outbid other potential buyers. Furthermore, since the definition of like-kind property is fairly broad, there is

also concern among farmers and environmentalists that like-kind exchanges have encouraged residential and commercial developers to purchase more farmland than would have been possible without the associated tax benefits.

Using data from the Internal Revenue Service’s (IRS) Sales of Capital Assets Panel Study, ERS researchers found that 1031-exchanges involving farmland represent a relatively small share of all tax-deferred exchanges—about 2 percent between 1999 and 2003. Exchanges involving farmland accounted for roughly 6 percent of all farmland dispositions (sales plus exchanges) reported to the IRS over the same period.

Despite their limited use, however, 1031-exchanges can be important for some farmland owners. Over a 5-year period, landowners making like-kind exchanges of farmland for farmland deferred \$43,300, on average, in capital gains taxes. In essence, farmland-for-farmland exchanges can be thought of as “rollover” investments. In contrast, landowners who sold farmland paid \$5,200 in capital gains taxes, on average.

While ERS researchers found a great deal of year-to-year variability in the use of 1031-exchanges involving farmland, for the most part, farmland was exchanged for other farmland rather than for nonfarm property. In particular, relatively few exchanges involved other property (such as a shopping center) being exchanged for farmland, suggesting that like-kind exchanges were not used extensively by investors planning on converting farmland to nonfarm uses. *W*

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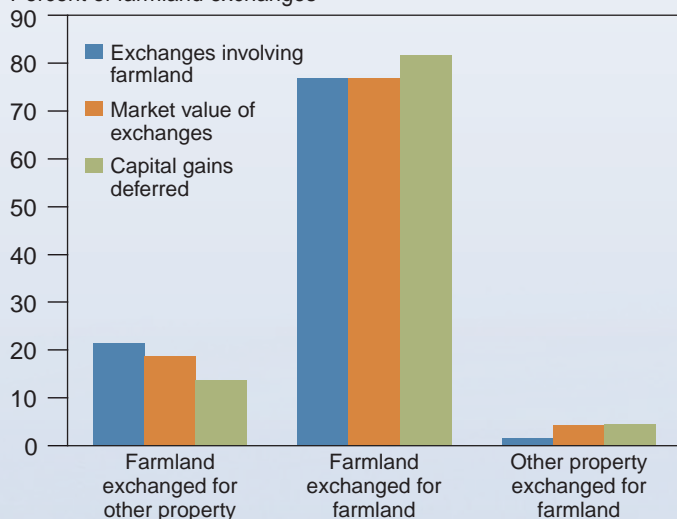
**Mike Brady**

### This finding is drawn from . . .

“Tax-deferred exchanges of farmland: theory and evidence from federal tax data,” by James M. Williamson, Michael P. Brady, and Ron Durst, in *Agricultural Finance Review*, Fall 2010, Vol. 70, No. 2, pp: 214-230, available at: <http://hdl.handle.net/10113/48138/>

### Most like-kind exchanges involving farmland between 1999 and 2003 were for other farmland

Percent of farmland exchanges



Source: USDA, Economic Research Service analysis of Internal Revenue Service data.







# Food Spending Adjustments During Recessionary Times

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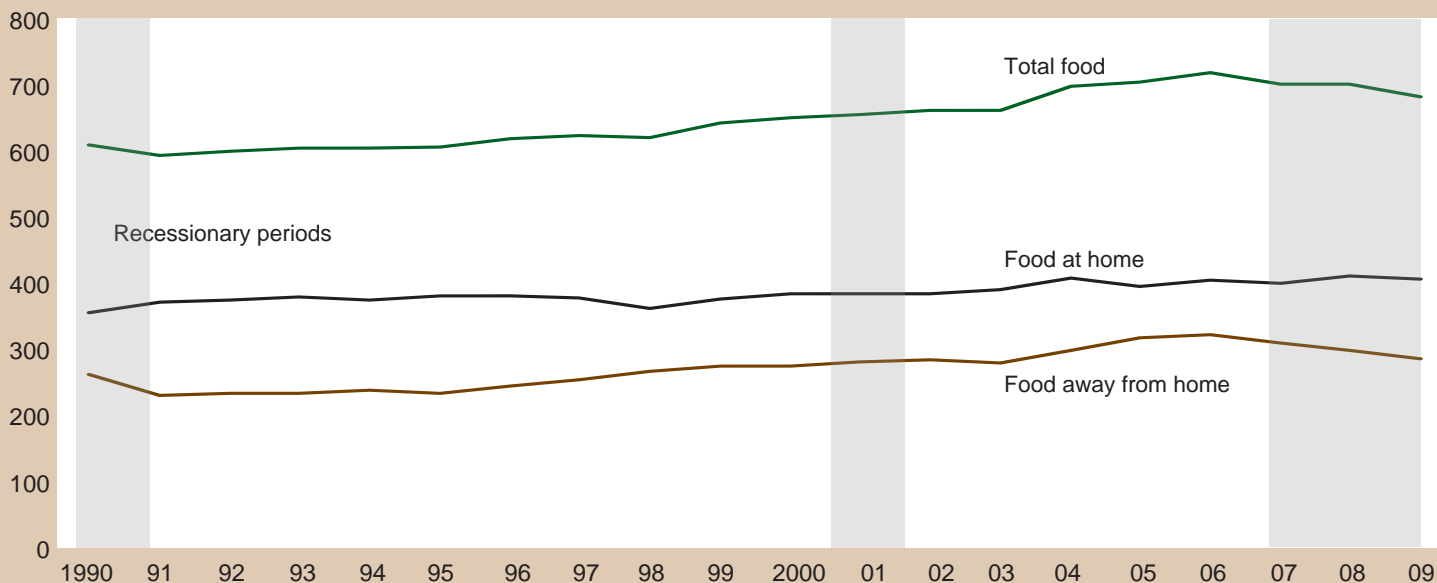
- During the 2007-09 recession, inflation-adjusted food expenditures by U.S. households fell 5 percent—the largest decrease in at least 25 years.
- Spending patterns differed by income level, with middle-income households curbing expenditures the most.
- Households responded to the recession by cutting back on eating out and by economizing on grocery purchases.

The 2007-09 recession was the longest period of economic decline since the Great Depression of the 1930s. Faced with falling incomes and economic uncertainty, many Americans economized on their food purchases in 2007-09. The decrease in aggregate food spending by all U.S. households during the recession, which officially began in December 2007 and ended in June 2009, represents the largest inflation-adjusted drop recorded by the Bureau of Labor Statistics' (BLS) Consumer Expenditure Survey since the survey began in 1984.

A salient feature of the recent recession was a significant and sustained increase in unemployment. National unemployment averaged 9.3 percent in 2009, up from 4.6 percent in 2006. Real (inflation-adjusted) average household income fell from \$60,533 in 2006 to \$59,067 in 2009 (in 2006 dollars). In addition, food prices increased substantially during the early part of the recession. Food prices peaked in 2008, when the annual rate of food price inflation was 5.5 percent. Even though food prices started to decline in February 2009, the average annual growth rate was still almost 3.8 percent between 2007 and 2009. This double squeeze of lower incomes and higher food prices put pressure on consumer expenditures.

## Total food expenditures adjusted for inflation dipped during the 2007-09 recession

Annual food expenditures (2006 dollars, billions)



Source: USDA, Economic Research Service calculations using data from the Bureau of Labor Statistics' Consumer Expenditure Survey and Consumer Price Index, 1990-2009.

Households spent less money eating out during the 2007-09 recession.

## Consumers Reduced Food Spending . . .

Two public data sources—ERS's Food Expenditure Tables and the BLS Consumer Expenditure Survey (CE)—track U.S. food spending over time, and both showed declines during the 2007-09 recession (see box, "The ERS Food Expenditure Tables and BLS Consumer Expenditure Survey"). The CE data allow a look at household-level spending and trends. According to the CE, real total food spending by U.S. households declined 5 percent between 2006 and 2009. In 2006, before the recession began, total food spending by all households peaked at \$726 billion, according to calculations based on the CE and the BLS Consumer Price Index. By 2008, real food spending in 2006 dollars was down to \$709 billion, and in 2009, spending dropped even more, to \$690 billion.



Annual reductions in food-away-from-home spending, such as at fast food places and sit-down restaurants, were largely responsible for the decrease in household food expenditures during the recession. Real away-from-home spending declined 11.5 percent between 2006 and 2009. Spending in the grocery aisle (food at home) increased from 2007 to 2008, as consumers replaced restaurant meals with at-home eating. In 2009, however, real at-home food spending dropped, as consumers economized further on their grocery bills.

Trends in per capita food expenditures over this period echoed the aggregate trends. Real average annual per capita food spending declined 6.6 percent, from \$2,444 in 2006 to \$2,283 in 2009 (in 2006 dollars). Food away from home fell 12.9 percent, accounting for most of the decline in per capita spending. At-home per capita food spending, on the other hand, decreased only 1.6 percent.

A look back at previous recessions shows that spending patterns varied. In the 1990-91 recession, spending responses were similar to those in the 2007-09 recession. During the 8-month 1990-91 recession, aggregate spending on total food declined 3.5 percent, with a 4.0-percent increase in at-home spending and a 13.8-percent drop in away-from-home spending.

The 2001 recession also lasted 8 months, but the increase in unemployment in that timeframe was less than in 1990-91. For the milder 2001 recession, there were smaller adjustments to food expenditures. Away-from-home food spending declined 0.4 percent, while at-home food spending increased 2.2 percent. Thus, overall food spending went up 1.1 percent.

### ... With Middle-Income Households Cutting Back the Most

Aggregate expenditures can mask spending adjustments made by different types of households. CE data disaggregated by household demographics reveal that during the 2007-09 recession, middle-income households cut total food spending by more than any other group. Households in the middle quintile of income (the middle 20 percent of the income distribution), with an average income of \$46,012, decreased their real food expenditures by 12.5 percent from 2006 to 2009. Households in the lowest quintile (average income of \$9,846) cut spending 1.8 percent, while the highest quintile (average income of \$157,631) reduced food spending 5.7 percent.

Food expenditures at home and away from home followed similar patterns,

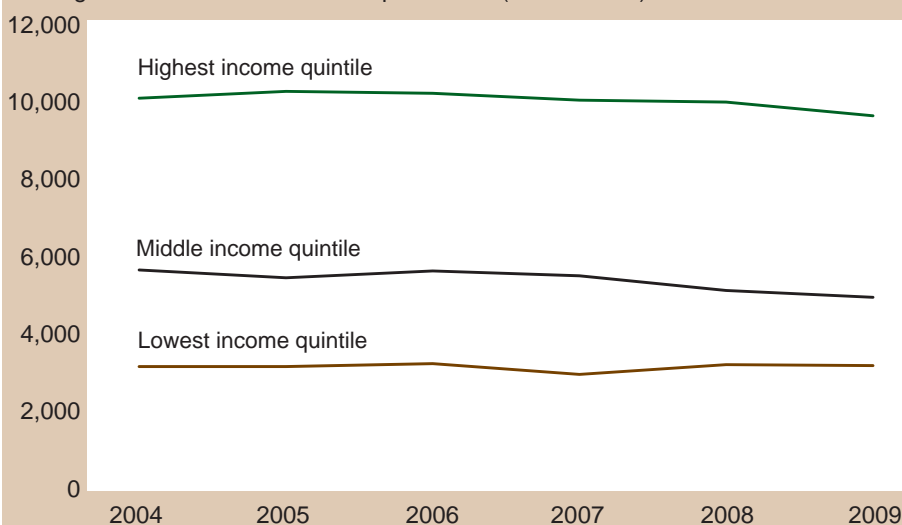


USDA/ERS

Consumers stretched their grocery budgets through sales and coupons.

### Middle- and high-income households reduced inflation-adjusted food expenditures more than low-income households

Average annual household food expenditures (2006 dollars)



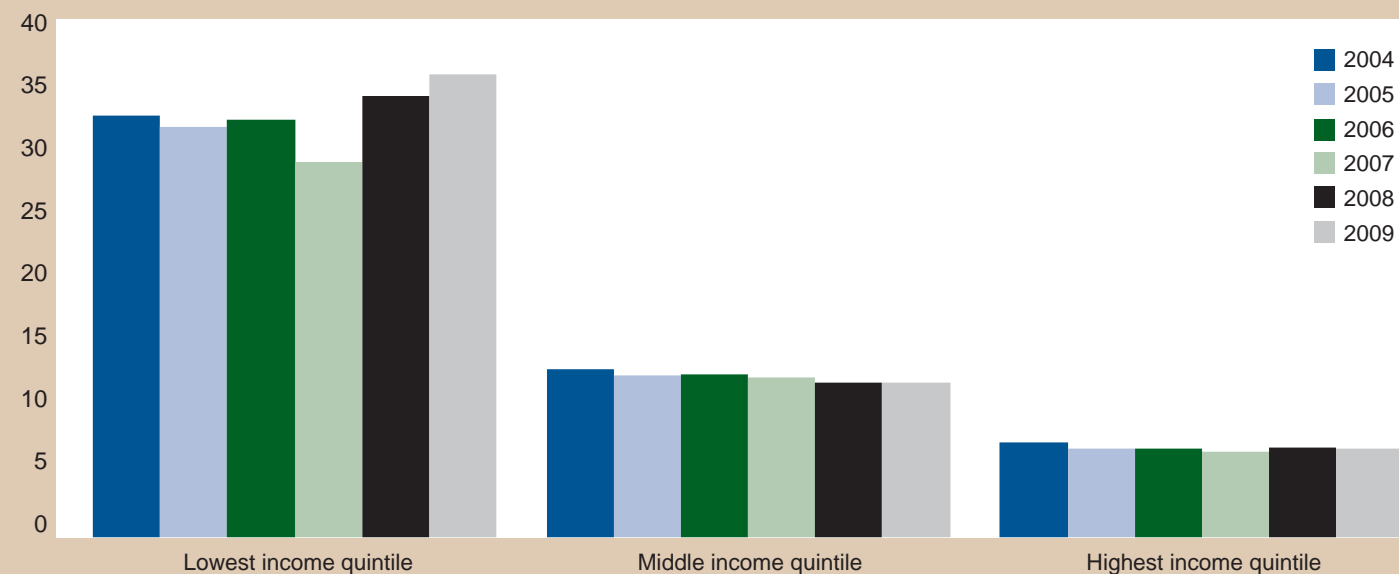
Note: Average annual incomes for the quintiles in 2009 were \$9,846 for the lowest, \$46,012 for the middle, and \$157,631 for the highest.

Source: USDA, Economic Research Service calculations using data from the Bureau of Labor Statistics' Consumer Expenditure Survey and Consumer Price Index, 2004-09.



## Low-income households spent the greatest portion of income on food

Percent of income spent on food



Note: Average annual incomes for the quintiles in 2009 were \$9,846 for the lowest, \$46,012 for the middle, and \$157,631 for the highest.

Source: USDA, Economic Research Service calculations using data from the Bureau of Labor Statistics' Consumer Expenditure Survey, 2004-09.

with away-from-home spending declining more than at-home spending among all five income levels. Real expenditures by middle-quintile households fell the most for both food at home (6.4 percent) and food away from home (20.8 percent). The lowest quintile households actually increased their real food-at-home spending during the recession by 3.2 percent, and they reduced food-away-from-home spending by 11.9 percent. The highest quintile households, on the other hand, trimmed their budgets for both food at home (2.8 percent) and food away from home (8.8 percent).

### SNAP Relieved Some Pressure on Low-Income Households

Reductions in food expenditures by low-income households may not have been as large as those by middle-income households for several reasons. First, even before the recession, low-income house-

Food assistance benefits helped low-income families cope with the recession.



USDA/FNS

## The ERS Food Expenditure Tables and BLS Consumer Expenditure Survey

Both ERS and the Bureau of Labor Statistics (BLS) produce estimates of U.S. food spending. The main difference between these two data series is that ERS Food Expenditure Tables reflect food spending from the supply side (sales reported by food companies), while BLS's Consumer Expenditure Survey (CE) data reflect the demand side (spending reported by households).

ERS bases its Food Expenditure Tables on data from the U.S. Census Bureau and industry publications. Some of the data go back to 1869. The Food Expenditure Tables provide estimates of sales by the food industry to consumers, businesses, nonprofits, and government. Therefore, the tables include spending by schools (such as the total cost of free and reduced-priced meals), universities, day care centers, hospitals, and the military.

The CE consists of two separate household surveys. One is a quarterly interview, and the other is a weekly diary in which respondents record their food expenditures. The CE sample includes only people living in civilian households and therefore does not capture expenditures by college students in dormitories or by military families living on military bases.

One data source may offer benefits over the other, depending on the research need. The Food Expenditure Tables allow analysis of specific sectors of the food industry. Food sales can be separated by type of outlet or retailer, such as supermarkets, warehouse clubs and supercenters, and others. This disaggregation of data by industry sectors allows trends to be analyzed, such as whether supermarket sales suffered more or less than warehouse club and supercenter sales during the 2007-09 recession.

CE data, on the other hand, can be disaggregated by type of food (such as bread, beef, or apples) and by household demographics (including income, presence of children, or race). CE data can be used, for example, to determine whether low-income households spend more or less on specific food categories than higher income households.

a family of two adults and two elementary school-age children was \$577 per month.

Data from the past 10 years of Current Population Survey Food Security Supplements show that households with incomes below the Federal poverty level spent an average of 7 percent less than the value of the Thrifty Food Plan on at-home food each week. In comparison, households with incomes above 185 percent of the poverty level spent 39 percent more than the value of the Thrifty Food Plan for their grocery foods.

For low-income households, even these low levels of food expenditure account for a large share of household income. In 2006, households in the lowest income quintile spent 32.0 percent of their income on food. The recession led to increases in this already high share. Food spending as a share of income for households in the lowest income quintile grew to 35.6 percent in 2009—putting further pressure on thin budgets. Over the same period, food spending as a share of income declined for middle-income households from 12.5 to 11.9 percent and remained flat for the highest income quintile at 6.8 percent.

A second reason for the smaller drop in food spending by low-income households is the additional financial support given to these households from the American Recovery and Reinvestment Act of 2009 (ARRA). In April 2009, ARRA increased benefit levels for USDA's Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) and expanded eligibility for jobless adults without children. After these enhancements, SNAP participation and real food spending by low-income households increased—and food security improved.

holds' food budgets were stretched thin, with little room for further reductions. Many low-income families were already spending less than the cost of USDA's Thrifty Food Plan. The Thrifty Food

Plan specifies types and quantities of commonly consumed foods that can be prepared at home to obtain a nutritious, palatable diet at a low cost. In December 2009, the cost of the Thrifty Food Plan for

Food security is the ability to consistently provide adequate food for active, healthy living for all household members. A 2011 ERS study found that food security among low-income households increased by 2.2 percentage points from late 2008 to late 2009, while it remained unchanged among households with incomes somewhat above eligibility cutoffs for SNAP.

### Tough Times Lead to Economizing

During the 2007-09 recession, Americans of all income levels tightened their belts, primarily by eating out less. According to ERS's Food Expenditure Tables, which include all sales by the food industry to consumers, governments, businesses, and nonprofit organizations, away-from-home food spending dropped from \$533 billion in 2006 to \$513 billion

in 2009 (in 2006 dollars). Real sales at full-service restaurants dropped by 4.5 percent during the recession, and sales at limited-service eating places, such as fast food outlets, declined by 2.6 percent. Sales of meals and snacks also declined at all other food-away-from-home segments between 2006 and 2009, including hotels and motels (8.8 percent); stores, bars, and vending machines (7.3 percent); and schools and colleges (0.8 percent).

Food-at-home sales also declined during the recession. ERS's Food Expenditure data show that inflation-adjusted sales in this category fell 1.3 percent from 2006 to 2009—the only 3-year drop in real sales over the past decade. Previous ERS research found that the various ways American households save on their at-home food spending included taking

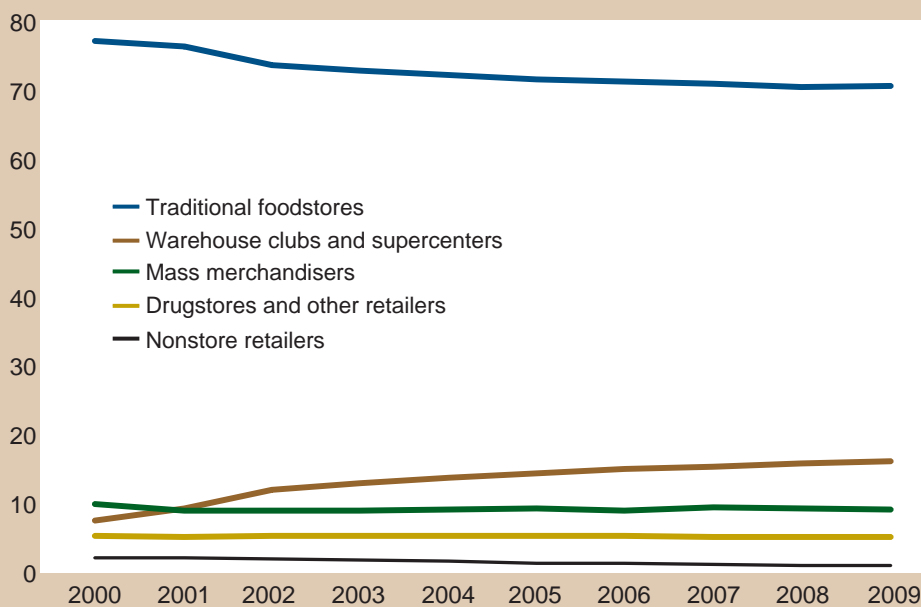
advantage of sales, promotions, and coupons in stores where they regularly shop; substituting comparable, but lower cost foods; and seeking stores that offer lower prices and more cost-effective selections.

ERS research reveals that during the recession, sales of private-label products, or store brands, continued to expand faster than sales of well-known national brands, partly because recession-strapped shoppers sought out these more economical options. In 2009, a record-setting 810 new private-label food and beverage products appeared on U.S. retail shelves—7 times more than in 2001. Similarly, consumers looking to stretch their food dollars often cut back on convenience. ERS researchers examined recent sales of bunches of spinach, heads of lettuce, and washed packaged leafy greens. They found that sales of packaged leafy greens decreased relative to sales of unpackaged greens when consumers' incomes fell (see "Consumers Cut Back on Convenience But Not Necessarily Quantity When Incomes Fall" on page 4 of this issue).

Households may also reduce food spending by shopping at different types of stores. The growth of food offerings by warehouse club stores and supercenters has expanded the range of shopping options available to consumers. ERS data on retail outlets show that traditional foodstores, including supermarkets, convenience stores, other grocery stores, and specialty food stores, have lost food sales shares to nontraditional foodstores, particularly warehouse clubs and supercenters. Between 2000 and 2006, the share of total retail food sales by traditional foodstores fell from 76.8 percent to 70.9 percent, continuing a long-term trend. The

### Growth in the share of sales at warehouse clubs and supercenters slowed during the 2007-09 recession

Percent of total food-at-home sales



Source: USDA, Economic Research Service, Food Expenditure Tables, table 14.





USDA/ERS

## Expanded private label options gave shoppers the chance to save even more.

recession saw a slowdown of that trend, as the share of total food sales held by traditional foodstores fell only slightly to 70.2 percent in 2009. The share of food sales held by warehouse clubs and supercenters continued to increase during the recession, from 14.6 percent in 2006 to 15.8 percent in 2009.

### Will Long-Term Trends Return?

The 2007-09 recession was a time of shifting food expenditure patterns. Many American households traded the convenience of eating out for the more time-intensive but potentially more frugal practice of eating in, and they shopped more carefully in the grocery aisle. Compared with the recent downturn, the recessions of 1990-91 and 2001 were of

shorter duration. The severity and nature of the 2007-09 recession suggests that the recession of the mid-1970s (November 1973-March 1975) might be a better indicator of what's ahead. The 1973-75 recession was also characterized by spikes in world food prices and unemployment. Overall food spending took a hit as well, but it rebounded to pre-recession levels by 1976 as the economy recovered from the recession. Whether or not the food spending adjustments of the 2007-09 recession will continue in the post-recession era remains to be seen, but 2010 ERS data suggest that food spending has begun to recover.  $\mathbb{W}$

### This article is drawn from . . .

*Exploring Food Purchase Behavior of Low-Income Households: How Do They Economize?* by Ephraim S. Leibtag and Phil R. Kaufman, AIB-747-07, USDA, Economic Research Service, June 2003, available at [www.ers.usda.gov/publications/aib747/aib74707.pdf](http://www.ers.usda.gov/publications/aib747/aib74707.pdf)

"Food Security of SNAP Recipients Improved Following the 2009 Stimulus Package," by Mark Nord and Mark Prell, in *Amber Waves*, Vol. 9, Issue 2, June 2011, USDA, Economic Research Service, available at: [www.ers.usda.gov/amberwaves/june11/features/foodsecuritysnap.htm](http://www.ers.usda.gov/amberwaves/june11/features/foodsecuritysnap.htm)

"Recession Brings Record Number of New Store-Brand Food Offerings," by Steve Martinez, in *Amber Waves*, Vol. 8, Issue 2, June 2010, USDA, Economic Research Service, available at: [www.ers.usda.gov/amberwaves/june10/findings/newstorebrand.htm](http://www.ers.usda.gov/amberwaves/june10/findings/newstorebrand.htm)

### You may also be interested in . . .

ERS Briefing Room on Food CPI and Expenditures, available at: [www.ers.usda.gov/briefing/cpifoodandexpenditures/](http://www.ers.usda.gov/briefing/cpifoodandexpenditures/)

ERS Briefing Room on the Food Marketing System in the U.S., available at: [www.ers.usda.gov/briefing/foodmarketingsystem/](http://www.ers.usda.gov/briefing/foodmarketingsystem/)




# Why Another Food Commodity Price Spike?

Ronald Trostle, [rtrostle@ers.usda.gov](mailto:rtrostle@ers.usda.gov)

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- Large and rapid increases have occurred for many food commodity prices during 2010-11.
  - Long-term production and consumption trends underlay rising food commodity prices, but worldwide production shortfalls and changes in trade policies and practices in a number of countries sparked the sharp surge in prices after June 2010.
  - Many of the long-term trends and short-run shocks contributing to the current price surge also played a role in previous price spikes.



With the 2008 food commodity price spike still on the minds of consumers, livestock producers, agribusinesses, and governments, prices began increasing again in January 2009, and by February 2011, many food commodity prices had climbed above 2008 peaks. Sharp increases in agricultural prices are not uncommon, but it is rare for two price spikes to occur within 3 years.

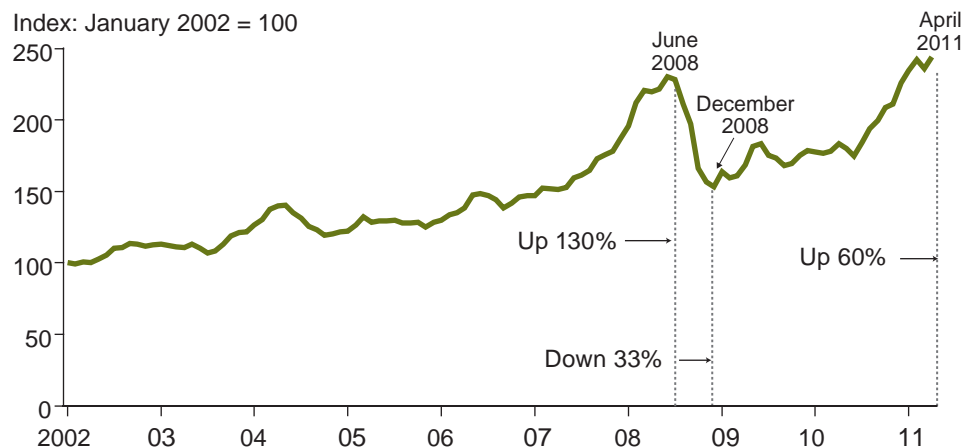
The short period between the last two price surges raises concerns and questions. Higher food commodity prices increased food insecurity among lower income consumers and in food-deficit countries. What are the causes of the increase in world agricultural prices, and what are the prospects for future price movements? Will the current period of high prices end with a sharp reversal as in previous price spikes, or have there been fundamental changes in global agricultural supply and demand relationships that may bring about a different outcome?

### A Decade of Large Price Swings

In 2002, world food commodity prices began increasing, reversing a 20-year downward trend. In early 2007, price increases accelerated, and by June 2008, the monthly food commodity price index compiled by the International Monetary Fund was up 130 percent from January 2002. Over the following 6 months, the index dropped by a third.

A similar price pattern emerged in early 2009 when the food commodity price index slowly began to climb. After June 2010, prices shot up, and by January 2011, the index exceeded the previous 2008 price peak. By April 2011, the monthly index had risen 60 percent over the preceding 2 years. Although there have been wide swings in food commodity prices in the past, they usually occurred 6-8 years apart.

**World food commodity price index rose 60 percent between December 2008 and April 2011**



Source: USDA, Economic Research Service using International Monetary Fund, International Financial Statistics.

For four basic crops (wheat, rice, corn, and soybeans), however, price fluctuations were greater than for the total food commodity index. Between January 2002 and June 2008, an index of monthly-average world prices for these crops rose 226 percent, compared with 130 percent for the overall food commodity index. During the next 6 months, the four-crop index declined

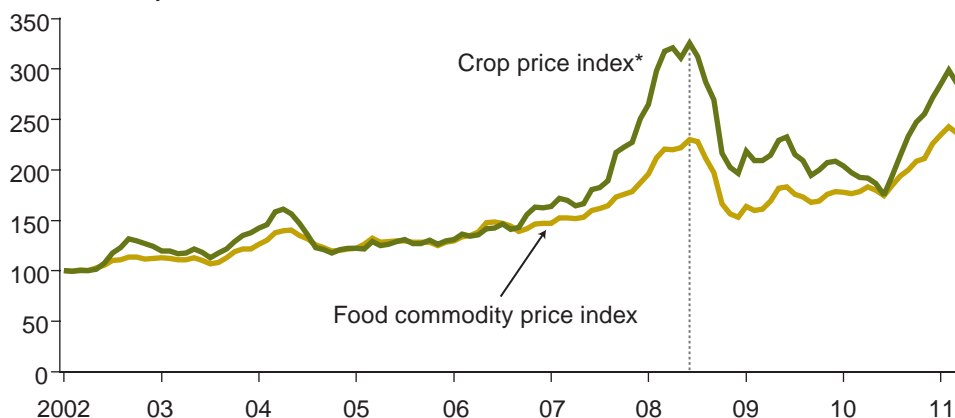
40 percent, while the food commodity index fell 33 percent. By June 2010, the four-crop index had fallen another 11 percent, while the food commodity index rose. During this latter period of December 2008 to June 2010, lower prices for the four crops were offset by increasing prices for sugar, vegetable oils, meats, and other commodities.



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## Basic crops had bigger price swings than total food commodities

Index: January 2002 = 100



\*Index of monthly wheat, rice, corn, and soybean prices weighted by global trade shares.

Source: USDA, Economic Research Service using International Monetary Fund, International Financial Statistics.

Between June 2010 and March 2011, the four-crop index rose 70 percent, compared with 39 percent for the food commodity index. Bread-quality wheat, corn, sugar, and vegetable oils saw the largest price increases. Rice prices rose very little, whereas in 2007-08, rice prices rose more than prices for any other commodity.

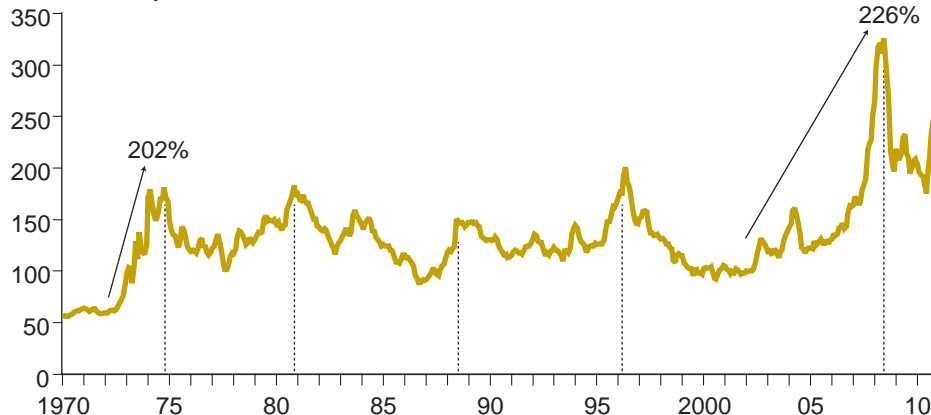
Nonagricultural prices increased even more than food commodity prices. Energy, metals, beverages, and agricultural raw materials prices rose during 2002-08 and then declined sharply after peaking in mid-2008. Since the low points, prices for these non-food commodities have risen more than the food commodity index, and all commodities but crude oil surpassed their 2008 peaks. The simultaneous swings in agricultural and nonagricultural prices suggest that global, economy-wide factors contributed to the surge in prices in both periods.

## The 2010-11 Price Surge: Sixth Spike in Four Decades

While the current price surge is still evolving, in each of the first five price spikes since 1970, large increases in agricultural prices were followed by sharp declines.

## World crop prices have spiked six times since 1970\*

Index: January 2002 = 100



\*Index of monthly wheat, rice, corn, and soybean prices weighted by global trade shares.

Source: USDA, Economic Research Service using International Monetary Fund nominal prices and weights.

Sometimes, prices rose to record highs before dropping. Usually, prices fell as much as they had risen after the conditions that prompted the increase were reversed. In the 1975 and 2008 spikes, prices only declined to a new plateau above historical average levels.

Most price spikes resulted from unusually large changes in supply and/or demand. In some cases, unexpected production shortfalls reduced available supplies; in others, production simply stagnated while demand rose. Based on the five historical price spikes, prices rose more than typical variations until supply and demand adjusted and prices subsequently declined. It may have taken several months or several years for the markets to adjust, but eventually they did so. Historical patterns suggest that the current surge in prices will also eventually reverse directions.

A number of common factors contributed to each of the six price spikes. The relative importance of each factor, however, as



well as the magnitude and duration of price movements, generally differed.

### Longer Term Trends Create Conditions for a Price Spike

A number of long-term trends in agricultural production and consumption laid the groundwork for a gradual upward trend in food commodity prices between 2002 and 2006, setting the stage for the sharp 2007-08 spike. Most of these same long-term factors underlie the 2010-11 price surge, including global population and per capita income growth, declining value of the U.S. dollar, increasing world per capita consumption of animal products, slower growth in world crop yields, rising energy prices, and growing global biofuel production.

Over the past decade, the world's population increased by more than 77 million people a year. A large portion of this increase occurred in developing countries, which also have seen a rapid growth in per capita incomes. As their incomes increase, consumers in developing countries increase per capita consumption of staple foods and diversify their diets to include more meats and dairy products, increasing the demand for grains and oilseeds used for feed.

The U.S. dollar's depreciation in 2002-08 facilitated growth in U.S. exports and put upward pressure on world commodity prices. Then, the dollar's appreciation, combined with the world economic recession, coincided with declining world prices in 2008-09, followed by renewed depreciation, economic growth, and rising prices after 2009.

The increase in biofuel production—ethanol in the United States and Brazil and biodiesel production in the EU, Argentina, and Brazil—has played a role in raising prices for corn, sugar, rapeseeds, and soybeans, as well as for other crops. Attributing most of the 2002-08 rise in food commodity



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prices to biofuel production, however, seems unrealistic. Crop prices dropped more than 30 percent during the last half of 2008, even though biofuel production continued to increase. Further, nonagricultural prices rose more than agricultural prices, and the price of corn (an ethanol feedstock) rose less than the prices of rice and wheat (not biofuel feedstocks).

Growth in global biofuel production has slowed considerably from rates exceeding 30 percent per year in 2005-08. Nevertheless, production continues to increase, and the shares of grain used for ethanol and vegetable oils used for biodiesel, relative to total use, continue to climb. While the expansion of biofuels was an important factor underlying the general rise of food commodity prices in 2002-08 and their movement to a higher plane, it is less clear how much impact biofuels production have had in the 2010-11 surge in prices.

### Short-Term Shocks Exacerbate Already Tight World Market Conditions

Probably the most significant factor contributing to the increase in staple food prices in 2010 and 2011 was a series of ad-

verse weather events. A severe drought in Russia and parts of Ukraine and Kazakhstan reduced production of all 2010 crops, particularly wheat. In late summer 2010, dryness and high temperatures during the grain-filling period reduced yield prospects for U.S. corn. About the same time, rain on nearly mature wheat crops in Canada and northwestern Europe reduced the quality of much of the crop to feed grade.

Adverse weather conditions continued, threatening 2011 production. Drought in Russia significantly reduced winter wheat plantings for the 2011 crop. In November 2010, drought and high temperatures associated with a La Niña weather pattern spread across Argentina, reducing prospects for corn and soybean crops. Dry fall, winter, and spring weather for the U.S. hard red winter wheat crop lowered 2011 production expectations in the southwestern Great Plains. Additionally, rains in Australia in late 2010/early 2011 downgraded much of eastern Australia's wheat crop to feed quality, further reducing global supplies of food-quality wheat. In early February 2011, a rare freeze destroyed some of Mexico's standing corn crop. Heavy and persistent

spring rains in the U.S. Corn Belt and the Northern Plains in the United States and Canada delayed planting of 2011 corn and wheat crops, reducing expected production. By April 2011, estimated global aggregate grain and oilseed stocks had fallen and the stocks-to-use ratio was almost down to the 2007-08 level and close to the 40-year low.

ERS has found that the ratio of global ending stocks to total use can be a reliable indicator of market prices (the lower the ratio, the tighter the market and the higher the price). Currently, the stocks-to-use ratios for corn and soybeans are near record lows. The stocks-to-use ratios for wheat and rice suggest reasonably comfortable stock levels, but the shortage of milling-quality wheat has put strong upward pressure on wheat prices. Stock-to-use ratios for cotton, total oilseeds, total coarse grains, and sugar are also low. These low ratios suggest strong

worldwide competition among crops for acreage in the 2011 planting season.

Meat prices, which did not contribute to higher 2002-08 food prices, did play a role in the recent increase. When feed costs increased in 2002-08, livestock producers responded by slowing production. As world economic growth rebounded in 2009 and 2010, consumers demanded more meat and prices began to rise. Beef and pork production could not respond in the short run because of multiyear cattle and hog production cycles. Thus, meat prices began to increase nearly a year before crop prices renewed their upward trend.

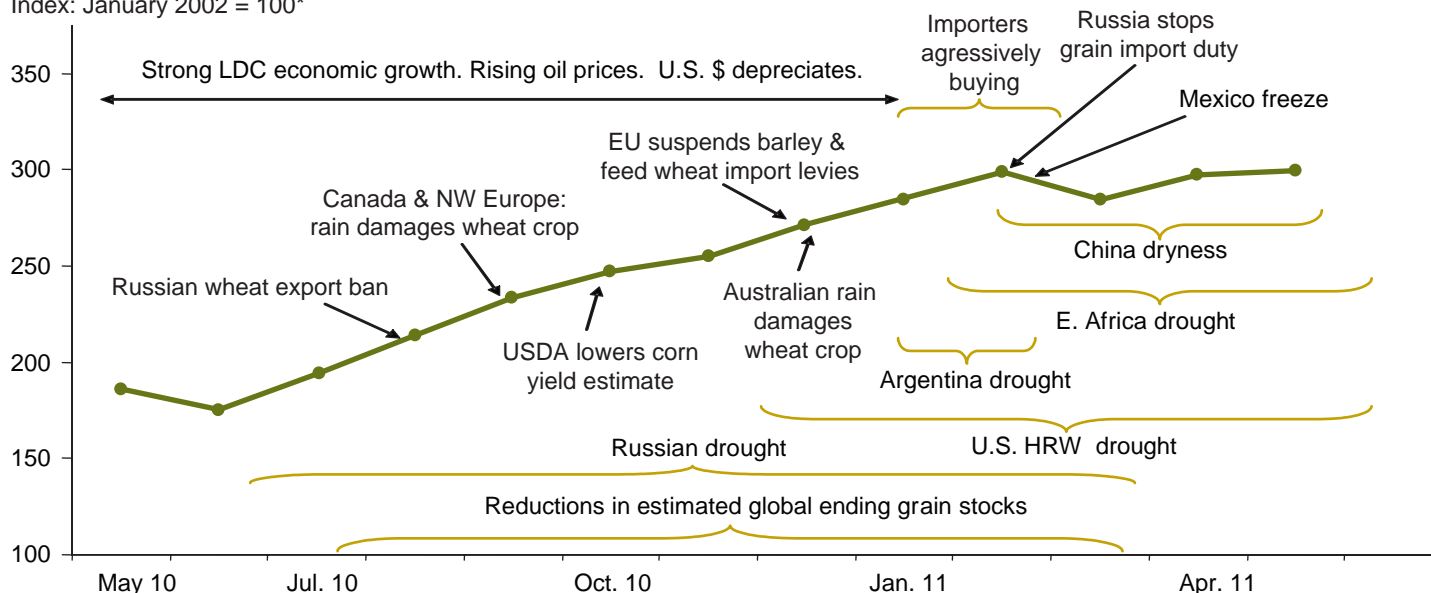
Just as in 2008, a number of countries imposed export restrictions or relaxed import controls in an attempt to shield their consumers from higher world food commodity prices. In August 2010, Russia imposed a wheat export ban after realizing the extent of its wheat shortfall. Some countries

also restricted crop exports. A number of importing countries reduced or suspended import tariffs. A few countries increased subsidies to reduce consumers' food costs. By restricting or relaxing controls, countries reduced exportable supplies and increased import demand at a time when world markets were already tightening because of production shortfalls and expanded demand arising from renewed income growth.

In late 2010, after world stocks of food commodities declined and prices increased, some importers began to contract aggressively for additional imports—first for wheat, then later for other food commodities. Countries that usually import sufficient quantities of grain to meet their needs for 2-3 months began to contract with suppliers for imports to meet their needs for 4-6 months.

### Adverse weather events were a major factor contributing to crop price increases

Index: January 2002 = 100\*

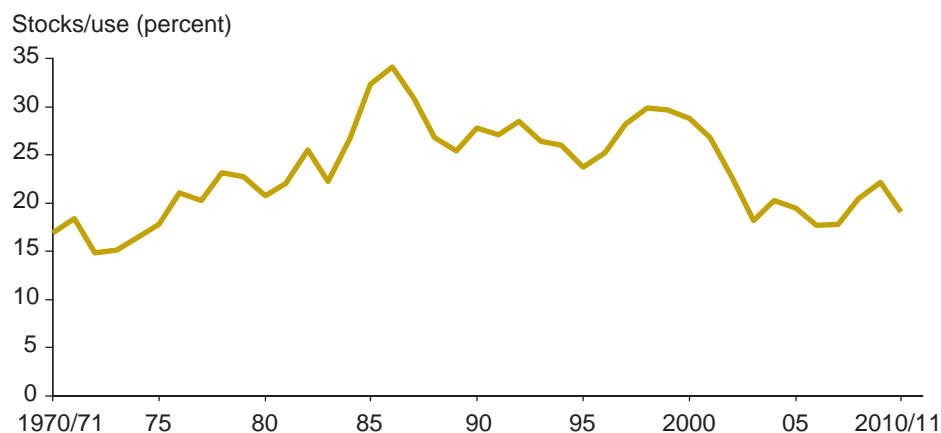


Notes: LDC=Least developed country. HRW=Hard red winter wheat. \* = Four-crop price index: Monthly wheat, rice, corn, and soybean prices, weighted by global trade shares.

Source: USDA, Economic Research Service using International Monetary Fund, International Financial Statistics.



## Stocks-to-use ratio for total world grains and oilseeds near record lows in 2011



Note: Oilseeds include annual crops of soybeans, rapeseed, and sunflowers.

Source: USDA, Economic Research Service using USDA's World Agricultural Supply and Demand Estimates and Production, Supply, and Distribution database, February 2011.

## Impacts of High Food Prices Are Extensive

Rising food prices can cause food insecurity rates to rise. Higher prices tend to negatively affect lower income consumers more than those with higher incomes. Lower income consumers spend a larger share of their income on food, and staple food commodities, such as corn, wheat, rice, and vegetable oils, account for a larger share of food expenditures for low-income families. Consumers in some low-income, food-deficit countries also tend to rely on imported food, usually purchased at higher world prices, making them more vulnerable to rising world prices. Compounding the situation, food aid donations shrink as prices increase because donors' fixed budgets purchase smaller quantities. Government trade and domestic food policies can affect how much of an increase in world prices gets passed on to consumers.

This time, however, the short-term impact of higher 2010-11 prices on food-

deficit, developing countries may be limited. Some countries in Sub-Saharan Africa, such as Nigeria and Ethiopia, harvested large crops in 2010 and actually have more domestically produced food available than they did in 2008. As a result, local prices have remained low. Also, imports contribute a small share of overall food supplies for many of these countries, so factors affecting domestic production, such as weather, play a more critical role in food security. There is little price transmission from the international market to many of these local markets, as a result of limited integration into global markets, poor market infrastructure, and subsidies provided by these governments.

The 2007-08 price spike gave rise to public demonstrations in several dozen countries protesting the higher cost of food. Many were peaceful, some were violent. Public protests and demonstrations in at least a half dozen countries can be indirectly associated with rising food prices.

## Where Will Prices Go?

Periods of rising and falling prices for agricultural products are not uncommon. Historically, during each price spike period, rising commodity prices constrained demand and increased production, which in turn, led to declining prices.

High 2011 crop prices are expected to stimulate increased plantings and more intensive use of other production inputs. Farmers around the world will have incentives to increase area planted to all crops, and, assuming average weather over the next year or so, world food production would be expected to increase. High prices will also limit grain and oilseed use by consumers, livestock producers, and industrial users.

On balance, higher production and lower use would raise global stocks of grains and oilseeds. Prices would be expected to peak and then to begin to decline, following the historical pattern of price movements. How quickly and how far prices fall will depend on many factors, including weather and its impact on production and stocks and future changes in trade policies and practices. *W*

### This article is drawn from . . .

*Why Have Food Commodity Prices Risen Again?* by Ronald Trostle, Daniel Marti, Stacey Rosen, and Paul Westcott, WRS-1103, USDA, Economic Research Service, June 2011, available at: [www.ers.usda.gov/publications/wrs1103/](http://www.ers.usda.gov/publications/wrs1103/)

*Global Agricultural Supply and Demand: Factors Contributing to the Recent Increase in Food Commodity Prices*, by Ronald Trostle, WRS-0801, USDA, Economic Research Service, July 2008, available at: [www.ers.usda.gov/publications/wrs0801/](http://www.ers.usda.gov/publications/wrs0801/)

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- Population size, 2010
- Population density, 2010
- Population change rate, 2000-2010
- Net migration rate, 2000-2009
- Natural change rate, 2000-2009
- Percent under age 18, 2005-2010
- Percent 65 years or older, 2005-2010
- Percent Non-Hispanic African American, 2005-2010
- Percent Non-Hispanic Asian, 2010
- Percent Non-Hispanic Native American, 2010
- Percent Hispanic, 2010
- Percent Multiple Race, 2010
- Percent foreign born, 2005-2009
- Percent European born, 2005-2009
- Percent Mexican born, 2005-2009
- Immigration rate, 2000-2009
- Percent non-English speaking, 2005-2009
- Percent with no high school degree, 2005-2009
- Percent with high school degree only, 2005-2009
- Percent with some college experience, 2005-2009
- Percent with college degree or higher, 2005-2009
- Average household size, 2005-2009
- Percent female-headed households, 2005-2009

- Percent 65+ living alone, 2005-2009
- Percent of homes owned, 2005-2009

### Jobs

- Employment change rate, 2008-2009
- Unemployment rate, 2009
- Percent employed in agriculture, 2005-2009
- Percent employed in manufacturing, 2005-2009
- Percent employed in services, 2005-2009
- Percent employed in government, 2005-2009
- Median household income, 2009
- Per capita income, 2005-2009
- Poverty rate, 2009

### Agriculture

- Number of farms, 2007
- Percent land area in farms, 2007
- Average value of agricultural products sold, 2007
- Government payments per operation, 2007
- Percent of operators working off-farm, 2007
- Percent of farms with less than \$10,000 in sales, 2007
- Percent of farms with high-speed internet access, 2007

- Percent of farms with women operators, 2007
- Percent of operators 65 years old or older, 2007
- Percent of farms with direct sales for human consumption, 2007
- Percent of farms with agritourism or recreational services, 2007
- Percent of farms with value added commodities, 2007
- Percent of farms using Community Supported Agriculture, 2007

### County classifications

- Urban Influence code, 2000
- Rural-urban continuum code, 2000
- Metro, 2000
- Nonmetro, 2000
- Micropolitan, 2000
- Nonmetro, outside micropolitan, 2000
- Nonmetro, adjacent to metro, 2000
- Nonmetro, nonadjacent to metro, 2000
- Farm-dependent, 1998-2000
- Manufacturing-dependent, 1998-2000
- Nonmetro recreation-dependent, 1997-2000
- Retirement-destination, 1990-2000
- Creative class, 2000
- High natural amenities
- Persistent poverty, 1970-2000
- Low education, 2000
- High out-migration, 1988-2008



# Rising Food Prices and Declining Food Security

## Evidence From Afghanistan

Anna D'Souza, [adsouza@ers.usda.gov](mailto:adsouza@ers.usda.gov)

- In Afghanistan, the 2007/08 rapid rise in wheat prices impacted urban and rural household food security, with observed declines in food consumed, calories, protein, and dietary diversity.
- Households traded off quality for quantity, moving away from micronutrient-rich foods like meat, fruit, and vegetables toward staples.
- Food price shocks can exacerbate chronically low levels of nutrient intake in countries with large populations living in poverty with generally poor diets.







In 2008, the price of wheat—the dietary staple—rose dramatically in Afghanistan due to a confluence of international (high global food prices), regional (export restrictions in neighboring trading partner countries), and domestic (drought) factors. Analysis of consumption and price data from the National Risk and Vulnerability Assessment 2007/08 (NRVA) shows that the price increase led to a decline in food security across rural and urban areas. The implications of greater food insecurity for Afghan households can be serious; even a short period of low nutrient intake can have long-term repercussions for young children in developmental stages, pregnant mothers, the elderly, or other vulnerable groups.

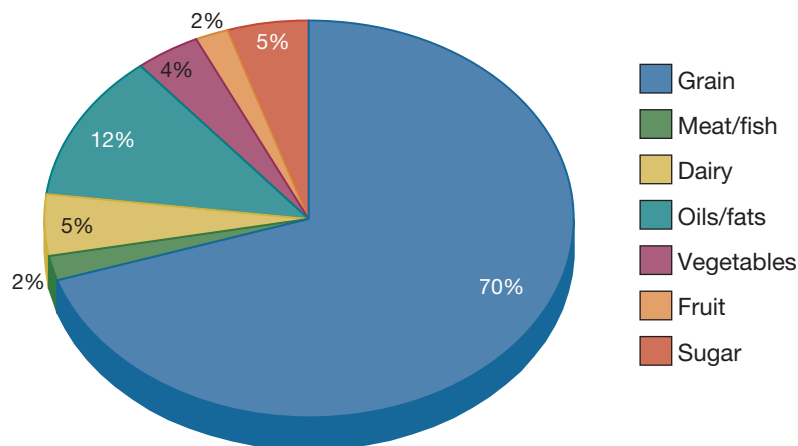
With a long history of political instability and conflict, as well as weak infrastructure and mountainous terrain, Afghanistan is particularly vulnerable to economic and natural shocks. Recent increases in the level and volatility of food prices pose a threat to countries like Afghanistan, where large populations often live in a state of food insecurity (defined as limited or uncertain availability of nutritionally adequate and safe foods).

Understanding how households respond to price shocks can help national and local governments and aid agencies design interventions and respond to local needs during economic crises or natural disasters. Such efforts are particularly important in poor, conflict countries where there is often limited data and analysis pertaining to food consumption and household coping mechanisms.

### **Afghanistan Is One of the World's Poorest, Most Food-Insecure Countries**

After decades of war and political instability, landlocked Afghanistan remains one of the world's least-developed nations.

#### **The Afghan diet: Grains make up the largest share of calories**



Source: USDA, Economic Research Service calculations based on data from the National Risk and Vulnerability Assessment for 2007/08.

Estimates from the International Monetary Fund show the gross domestic product averaged US\$470 per capita between 2007 and 2010. Based on the broader set of indicators, such as health and education, used in the United Nations Development Programme's Human Development Index, Afghanistan ranked 181st out of 182 countries in 2008. And, according to the World Food Programme, Afghanistan is among the world's most vulnerable countries in terms of absorbing food and fuel price shocks.

Based on ERS research, Afghanistan had a nutrition gap—the difference between available food and food needed to support intake of 2,100 calories per capita per day—of approximately 2 million tons in 2008; only North Korea had a larger estimated nutrition gap in that year. Using NRVA survey data, ERS researchers found that approximately 28 percent of the Afghan population did not meet the minimum daily energy requirements of 2,100 calories per day per person.

#### **Wheat Is the Main Staple...**

The composition of the Afghan diet is similar to that of populations in other de-

veloping countries. Over 80 percent of total calories come from grains, oils, and fats, with the majority of calories (54 percent) coming from wheat. On average, Afghan households spend over 60 percent of their budgets on food, making them particularly vulnerable to declines in purchasing power brought on by increases in food prices.

#### **...and the Largest Production Crop**

The Afghan economy is largely based on agriculture; major crops include wheat, rice, maize, barley, vegetables, fruit, and nuts. About 80 percent of the population live in rural areas, where farming and agricultural labor are important sources of livelihood. About 67 percent of rural households and 15 percent of urban households have access to agricultural land—an important resource when food prices are high.

Over 70 percent of cultivated crop area in Afghanistan is devoted to wheat. Due to large fluctuations in weather and sporadic conflict, agricultural production is highly volatile and the country is dependent on its trading partners to meet any shortfalls. According to ERS research, imports made



Afghan bread displayed in bakery.

Dean Jolliffe

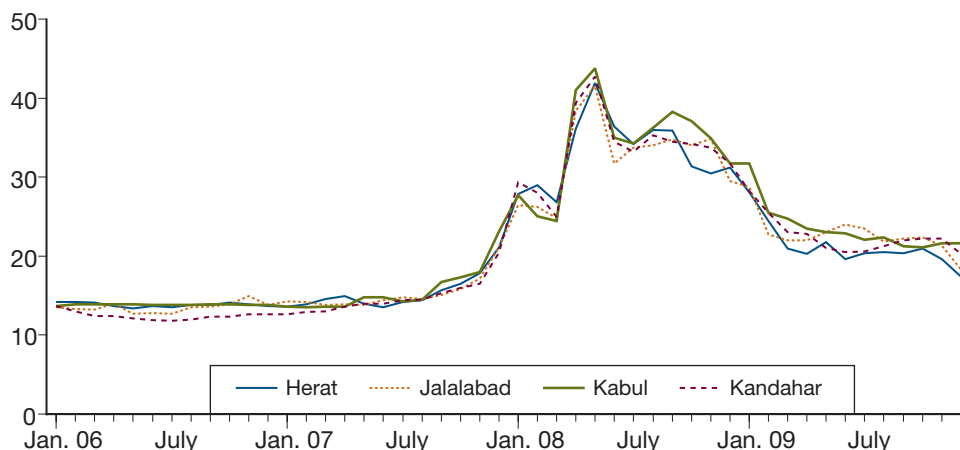
up about 30 percent of annual consumption from 2000 to 2008.

During 2007/08, Afghanistan experienced several shocks that disrupted its food supply network, causing food prices to soar throughout the country. The 2008 wheat harvest of 1.5 million metric tons (1 metric ton=2,200 pounds) was the worst since 2000 due to drought and early snow melt. In February 2008, the Afghanistan

Government eliminated import tariffs on wheat and wheat flour, but the downward effect on prices was small due to export bans in Pakistan (Afghanistan's biggest supplier), Iran, and Kazakhstan, as well as rising international food prices. Between fall 2007 and summer 2008, domestic wheat flour prices increased by over 100 percent, peaking around May-July 2008.

### Wheat flour prices throughout Afghanistan more than doubled from 2007 to 2008

Price per kg in Afghani



Source: USDA, Economic Research Service calculations based on data from the Food and Agriculture Organization of the United Nations, Global Information and Early Warning System.

## Analyzing the Impact of the Wheat Flour Price Shocks

ERS researchers used NRVA survey data and econometric techniques to estimate the impact of rising wheat flour prices on household food security. The NRVA survey is a nationally representative sample of over 20,000 households from all 34 provinces of Afghanistan. It is unique in that it was conducted over 1 full year and was designed to be nationally representative for each survey quarter.

The analysis covered four measures of food security: the real value of monthly per capita food consumption; daily per capita calorie availability; daily per capita protein availability; and household dietary diversity. The measures relate to two specific dimensions of food security: access and utilization. Access refers to a household's ability to obtain food throughout the year, which depends on income, prices, and distance to local food markets. Utilization refers to the ability to process nutrients and energy from food, which depends on many factors, including dietary diversity and nutrient absorption, intra-household allocation of food, and hygienic preparation.

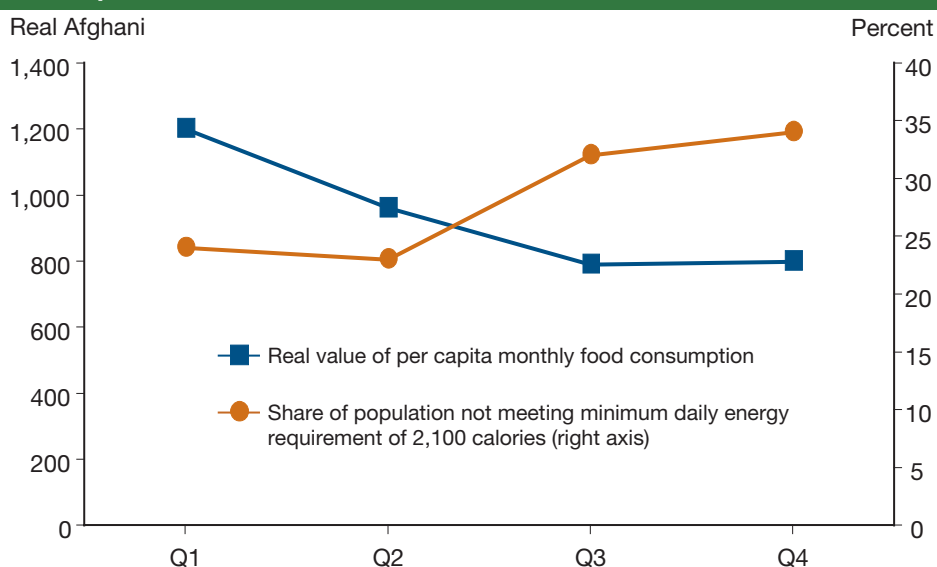
The *real value of monthly per capita food consumption* provides a measure of how much food is consumed. It is an important measure of household well-being and is often used by international aid organizations like the World Bank to analyze household poverty. The measure is calculated by multiplying prices by quantities of food consumed per capita over a month. The total is then deflated by price indices that account for differences across regions and over time to get the real value. For example, consider a mix of food worth \$100 in 2008 U.S. dollars. Once inflation is taken into account, the *real value* of the mix of food today is less than





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## Food security in Afghanistan deteriorated between August 2007 and September 2008



Source: USDA, Economic Research Service calculations based on data from the National Risk and Vulnerability Assessment, 2007/08.

\$100; if inflation is high, then the real value will be even smaller.

*Daily per capita calorie availability and daily per capita protein availability* relate to the number of calories and grams of protein contained in the food acquired by a household; these measures do not reflect actual intake levels since detailed food diaries are needed to obtain such information. Calorie availability is a commonly used measure in food security assessments. Protein is an essential macronutrient that supports hormone and enzyme functions and immune system health and is particularly important during developmental stages.

*Household dietary diversity* reflects the quality of a household's diet and is measured by the World Food Programme's food consumption score. The score represents how frequently households consume foods

from eight different food groups over a 1-week period: staples, pulses, vegetables, fruit, meat/fish, milk/dairy, sugar, and oils/fats. The measure is used in food security assessments across the globe.

### Price Shocks Led to Increases in Household Food Insecurity...

ERS research findings suggest a significant household response to rising food prices in Afghanistan, reflecting an overall decline in food security as measured by the four food security indicators described earlier. The estimation results imply that for a 1-percent increase in the price of wheat flour, Afghan households reduced the real value of monthly per capita food consumption by 0.20 percent. Thus, households cut back on the total amount of food consumed in response to declining purchasing power.

### ...Causing Households To Trade Off Quality for Quantity in Their Choice of Foods

To maintain calories as purchasing power declined, Afghan households changed the composition of their diets.

Thus, households were able to buffer the impact of the price shock on calorie availability to some extent. The results imply that for a 1-percent increase in the price of wheat flour, calories declined by 0.07 percent, less than half the observed decline in food consumption.

Similarly, the results imply a large decline in dietary diversity; for a 1-percent increase in the price of wheat flour, Afghan households reduced the diversity of their diets by 0.10 percent. The shift toward lower quality (less micronutrient-rich), cheaper foods (like staples) can be seen in the expenditure shares that households devoted to specific food groups, as well as a reduction in per capita protein availability. Higher wheat flour prices induced households to increase the total food expenditure shares devoted to grains and to reduce expenditure shares for the other major food groups (meat/fish, dairy, oils/fats, vegetables, fruit, and sugar). Additionally, the dietary shifts are observed in protein availability changes; for a 1-percent increase in the price of wheat flour,

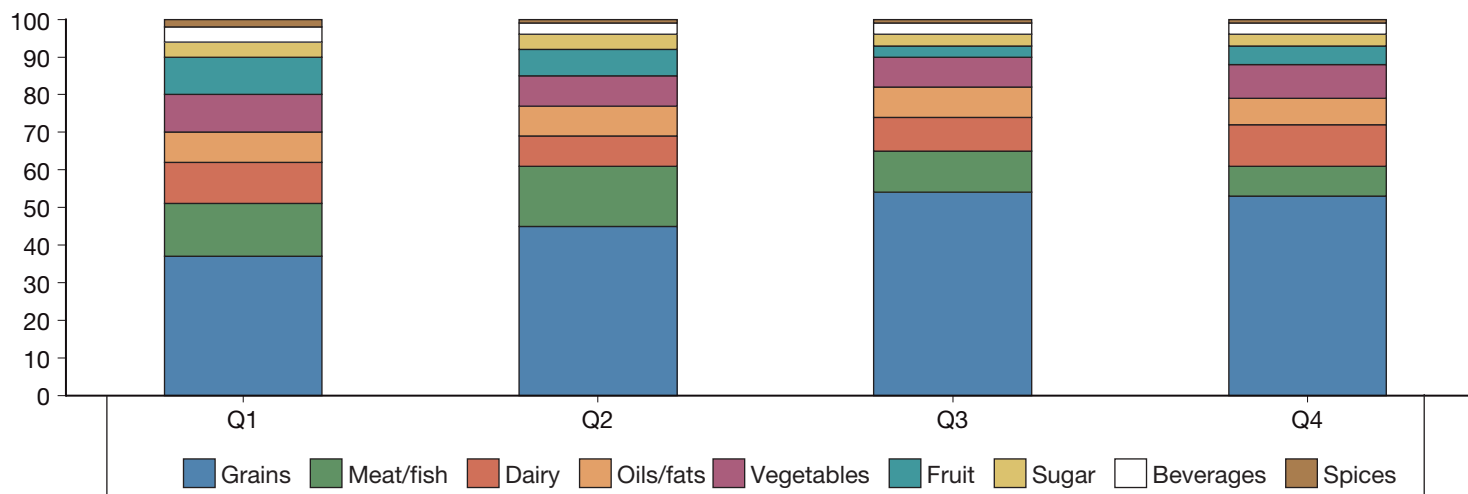
there was a 0.25-percent decline in daily per capita protein availability.

While the magnitude of these effects may appear small, the estimation results presented pertain to a 1-percent increase in prices. In 2007/08, however, wheat flour prices increased by more than 100 percent throughout Afghanistan. Therefore, there may have been serious repercussions for the food security status of Afghan households.

The changes in dietary diversity can be seen through shifts in calorie and expenditure shares devoted to various food groups as well. The estimated changes in calorie shares are less stark than the estimated changes in expenditure shares. Increasing wheat flour prices are associated with smaller shares of calories from fruit and oils/fats, a larger share from grains, but no observed change in calorie shares from meat/fish or from vegetables. These results may be due partly to a shift to lower quality, cheaper foods within the same food group. For example, if households began purchasing the cheapest meat possible, the expen-

### Afghan households spent more on grains and less on other foods as wheat prices increased between August 2007 and September 2008

Percent of expenditures



Source: USDA, Economic Research Service calculations based on data from the National Risk and Vulnerability Assessment, 2007/08.





Dean Jolliffe

diture share on meat/fish may decrease without an accompanying reduction in calorie share on meat/fish.

Taken together, these findings may indicate reduced micronutrient intake, with important implications for nutrition and health. Researchers at the International Food Policy Research Institute have linked low levels of dietary diversity to poor dietary quality and inadequate nutrient availability. According to the United Nations Children's Fund, micronutrient deficiencies have been linked to multiple negative outcomes for children, as well as adults, including impaired cognitive development, physical and mental disabilities, infant and maternal deaths, and lower productivity. According to the World Health Organization, undernutrition is a leading cause of child mortality worldwide.

### Household Responses Varied Across Rural and Urban Areas

Economic theory and empirical data suggest that urban or landless rural households are likely to be more adversely affected by food price increases than agri-

cultural rural households that can produce their own food. When food prices increase, purchasing power—the amount of a good that a consumer can buy with a given sum of money—declines. Some households, however, are less dependent on food purchases than others. For example, if a household is a net seller of food (the total value of food produced is greater than the total value of food consumed), then its income will increase as food prices rise, mitigating the decline in welfare due to lower purchasing power.

ERS researchers used two broad categories to examine differential effects of the wheat flour price increases in Afghanistan: (1) rural versus urban areas; and (2) households with versus households without access to agricultural land. In both categories, the former group is more likely to include some net sellers of food.

The analysis reveals that urban areas experienced a much greater decline in the real value of food consumption than rural areas. For a 1-percent increase in wheat flour prices, the value of real monthly per capita food consumption in rural areas

declined by 0.19 percent, while the decline in urban areas was 0.37 percent. Other studies on the impacts of the high food price inflation in 2007/08 also found a disproportionate impact on urban areas in terms of poverty and total consumption.

Urban households made large reductions in dietary quality—as measured by dietary diversity and protein availability—to maintain energy levels; thus, they did not experience a significant decline in calorie availability. Further, urban households exhibited a more pronounced shift from higher quality food groups toward grains—in terms of calorie and expenditure shares—than did rural households. Urban households reduced calorie shares from dairy, vegetables, fruit, and sugar, while rural households only reduced calorie shares from oils/fats and fruit. Rural households did not make large changes in dietary composition; thus, they experienced a small decline in calorie availability.

Differences in coping strategies for rural and urban households may be driven by stronger preferences for maintaining dietary quality in rural areas. Alternatively, rural households that engage in home food production may have had greater access to an assortment of foods, which would have made it relatively easier for them to maintain a more diverse diet as wheat prices rose.

The difference in impact of the wheat price increases on households with and without access to agricultural land was generally similar to that observed for households in rural and urban areas. Households with agricultural land experienced smaller declines in the real value of food consumption and dietary diversity but a slightly larger decline in calorie availability than households without access to

agricultural land. The impact of the wheat price increases on protein availability was similar for both groups.

### Wheat Flour Price Increases Led to Higher Wheat Demand in Urban Areas

Given the importance of wheat in the Afghan diet, ERS researchers examined changes in the demand for wheat products as measured by daily grams of wheat consumed per capita. At the national level, there was no observable change in total demand for wheat products associated with price increases. However, in examining the effects for urban and rural areas separately, ERS researchers found a large positive effect in wheat consumption in urban areas but no statistically significant effect in rural areas. This result may seem counter to the law of demand because higher prices usually lead to lower consumption. In this case, however, urban consumers were substituting wheat for other higher priced products (see box, “The Paradox of Giffen Goods”). As purchasing power declined, urban households made budgetary adjustments, shifting their consumption toward the cheapest foods to maintain energy levels. Wheat products provide the most calories per Afghani, so consumption of wheat products increased.

### Implications for Afghanistan and Beyond

The United Nations Food and Agriculture Organization estimated that in 2010, nearly a billion people in the world were undernourished with calorie intake below the minimum dietary energy requirement. Recent wildfires and export bans (Russia), flooding (Pakistan), and political instability (Middle East) have

### The Paradox of Giffen Goods

The increase in consumption of wheat products in urban areas following the wheat flour price increase of 2007/08 appears to be in contrast to the “Law of Demand,” which states that quantity demanded decreases as price increases. Though not conclusive, these results are broadly consistent with the paradox of Giffen goods—for which quantity demanded increases rather than falls as price increases. This paradox is driven by the fact that a Giffen good is an inferior good rather than a normal good. Holding prices constant, as income increases, the demand for a normal good increases, but the demand for an inferior good decreases.

The findings from the National Risk and Vulnerability Assessment suggest that wheat products are both inferior goods and Giffen goods. The increase in wheat prices induced households to buy other goods that were relatively cheaper after the price increase; however, since household purchasing power declined due to the price increase of a major household necessity, households were induced to buy more inferior wheat products. In urban areas, the purchasing power effect outweighed the substitution effect and overall, households purchased more wheat products.

added to international commodity price volatility and raised concerns about potential increases in food insecurity and global poverty. For households that spend the majority of their budgets on food, large increases in food prices erode purchasing power, disproportionately affecting poor households and threatening their nutrition and health. Potential policy interventions to mitigate the effects of food price shocks could include micronutrient supplementation programs based on food inflation indicators; employment-generation programs; incentives to encourage the adoption of yield-increasing agricultural practices; improvements in transportation and irrigation infrastructure; targeted food distribution programs; and wheat fortification programs. **W**

#### This article is drawn from . . .

*Wheat Flour Price Shocks and Household Food Security in Afghanistan*, by Anna D’Souza, ERR-121, USDA, Economic Research Service, July 2011, available at: [www.ers.usda.gov/publications/err121/](http://www.ers.usda.gov/publications/err121/)

#### You may also be interested in . . .

*Price Volatility in Afghanistan’s Wheat Market*, by Suresh Persaud, WHS-10D-01, USDA, Economic Research Service, May 2010, [www.ers.usda.gov/publications/whs/2010/04apr/whs10d01/](http://www.ers.usda.gov/publications/whs/2010/04apr/whs10d01/)

*International Food Security Assessment, 2011-21*, by Shahla Shapouri, Stacey Rosen, May Peters, Sharad Tandon, Fred Gale, Lisa Mancino, and Junfei Bai, GFA-22, USDA, Economic Research Service, July 2011, [www.ers.usda.gov/publications/gfa22/](http://www.ers.usda.gov/publications/gfa22/)



# Reducing Agriculture's Nitrogen Footprint: Are New Policy Approaches Needed?

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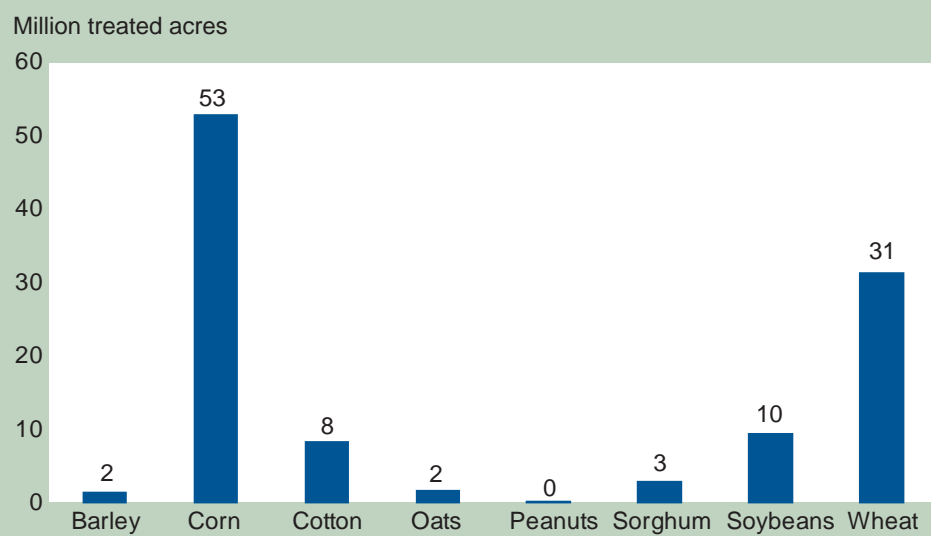
- Human-induced increases of nitrogen compounds entering ecosystems, primarily from agricultural fertilizer, have upset natural nitrogen balances and created a host of environmental problems.
- By improving nitrogen management, the agricultural sector can decrease its harmful effects on the environment.
- A range of policy instruments that currently are focused on other agro-environmental issues could be used to address different facets of nitrogen management and specific environmental problems.

Nitrogen is the single most important input a farmer can control to increase crop yields on nonirrigated fields. Given this, and the fact that nitrogen has been a relatively inexpensive input, farmers have an economic incentive to “apply a little extra” to ensure that crops have the necessary nutrients when they need them most. As a consequence, excess nitrogen remains in the soil and freely moves into water resources or into the atmosphere. Agriculture is the single largest source of nitrogen compounds entering the environment in the U.S., contributing 73 percent of nitrous oxide emissions, 84 percent of ammonia emissions, and 54 percent of nitrate emissions in recent years.

The production and release of nitrogen, however, has greatly changed the Earth’s natural balance of nitrogen. The influx of nitrogen compounds that can change form and move easily between air, land, and water, such as nitrate, nitrous oxide, and ammonia, contributes to both beneficial and harmful changes to ecosystems. Increased productivity in agricultural systems is a benefit. On the other hand, ozone-induced injury to crops and forests, acidification and over-enrichment (eutrophication) of aquatic ecosystems, biodiversity losses, visibility-impairing haze, and global climate change are all considered harmful impacts (see box, “Pathways for Nitrogen Losses”). Hypoxia in the Gulf of Mexico and the declining health of the Chesapeake Bay are examples of the consequences of excess nitrogen in the environment, especially when compounded with other factors like the loss of wetlands and the increase in impervious surfaces, such as asphalt roads and parking lots.



### In 2006, about 65 percent of treated U.S. crop acres did not meet nitrogen management criteria



Source: USDA, Economic Research Service using data from Phase II of USDA's Agricultural Resources Management Survey.

Nitrogen applied in excess of crop needs has the greatest risk of leaving the field and degrading air and water resources. Improved nitrogen management more closely matches nitrogen applications with the needs of growing crops, reduces the amount of excess nitrogen left on fields, and decreases nitrogen losses to the environment. Three criteria for “good nitrogen management practices” include:

- Rate—applying only the amount the crop needs;
- Timing—applying it in the spring when the crop needs it (and not before);
- Method—injecting or incorporating it into the soil (rather than leaving it on the soil surface).

All these actions, however, entail some cost or involve some degree of risk, so farmers may see little reason to alter their nitrogen management practices voluntarily.

### How Are We Doing?

About 69 percent of U.S. cropland planted with major field crops (barley, corn, cotton, oats, peanuts, sorghum, soybeans, and wheat), or 167 million acres, receives commercial and/or manure nitrogen. Corn accounts for 45 percent of U.S. crop acreage receiving manure and 65 percent of the 8.7 million tons of nitrogen applied by farmers each year.

Using data from USDA's Agricultural Resources Management Survey (ARMS), ERS researchers determined the extent to which farms are meeting the three criteria for good nitrogen management. In 2006, about 68 percent of crop acres receiving nitrogen met the rate criterion; 60 percent met the timing criterion; and 63 percent met the method criterion. Only about 35 percent of crop acres receiving nitrogen, however, met all three of the nitrogen management criteria, leaving 65 percent in need of improved management.

Corn is the most widely planted field crop and requires the most nitrogen per

acre. Thus, it is not surprising that treated corn acres—and the Corn Belt, regionally speaking—needed the most nitrogen management improvement. Demand for corn as a source of food and biofuels continues to increase, so widespread improved nitrogen management on corn fields could result in large environmental benefits.

### Policy Tools That Influence Nitrogen Management Decisions

Improved nutrient management has been a longstanding goal of U.S. conservation programs. USDA provides financial and technical assistance so farmers can adopt a suite of practices to reduce nitrogen losses to the environment, including nutrient management planning and manure management. Nitrogen-related problems persist, however, as seen by the large amount of cropland not being farmed using good nitrogen management practices.

On the surface, it might seem that farmers would want to lower fertilizer costs by reducing excess applications and maximizing overall nitrogen use efficiency. There are barriers, however, for farmers adopting improved nutrient management systems. First, improved management requires a level of information and training that many farmers do not have. Acquiring the skills necessary to interpret soil and tissue tests and to apply fertilizers more carefully can be time consuming and costly.

Second, correctly timing applications increases the risk of not having enough nitrogen in the field when crops need it. For example, inclement weather may prevent nutrient application at a critical time during the growing season, resulting in reduced yields and lost revenue. Farmers may consider applying excess fertilizer before the crop needs it to ensure that it

is always available and to insure against yield loss.

Even though improving nitrogen management in agriculture may impose costs on farmers, the potential for improving environmental quality justifies policies designed to encourage farmers to adopt nitrogen best management practices. An efficient policy would encourage farmers who could improve nitrogen use efficiency at least cost to adopt appropriate management practices. The most efficient policies would target improvements that can be made at least cost, provide farmers flexibility in how they reduce emissions, and have low monitoring and transaction costs.

### **Current Levels of Financial Assistance Are Inadequate To Improve Nutrient Management**

U.S. conservation policy has traditionally relied on financial and technical assistance through programs such as USDA's Environmental Quality Incentives Program (EQIP) to promote the adoption of best management practices. While such efforts are helpful, much more needs to be accomplished if U.S. cropland is to meet the three nitrogen management criteria of rate, timing, and method.

One of the drawbacks of a voluntary approach to nutrient management that relies on financial assistance is that there is no guarantee that those farmers who can reduce emissions at least cost will enroll in a program. A farmer's decision to enroll

is most likely based on private benefits, rather than on offsite improvements in environmental quality. Unless improving nutrient management also increases net returns, farmers will have to be compensated annually to cover lost income.

About 108 million acres of U.S. cropland need improved nitrogen management. Assuming that farmers would adopt nutrient management practices for an annual payment of \$8.88 per acre (the average EQIP payment rate made to farmers adopting nutrient management), the cost would be \$959 million per year, out of a total EQIP budget of about \$1.1 billion (2009-10). Since it could cost considerably more than this minimum payment to entice all farmers to adopt practices that increase nitrogen use efficiency, EQIP's current budget would be exhausted well before all acres were covered, even if all the other agro-environmental concerns addressed by EQIP are ignored. Targeting programs to areas with the most pressing nitrogen-related problems would reduce the cost but not increase the likelihood that farmers will enroll in the program.

Additional financial resources for improving nitrogen management could come from the private sector. In some situations, the beneficiaries of environmental quality improvements can pay farmers directly for those services. Developing markets for ecosystem services could encourage farmers to utilize

best nitrogen management practices (see "Creating Markets for Environmental Stewardship: Potential Benefits and Problems" in the September 2008 issue of *Amber Waves*).

Water quality trading is one example of such a market. Water quality trading can occur when a discharge limit is placed on regulated sources (such as sewage treatment plants) and those subject to regulation are allowed to meet their limits by purchasing reductions, or offsets, from lower cost sources of the pollutant. Evidence suggests that farmers can reduce nitrogen emissions at lower cost than sewage treatment plants. A number of water quality trading programs have been developed that allow farmers to sell offsets to regulated sources, and more are planned. However, design issues and high transaction costs have so far limited the success of these markets. The extent to which water quality trading markets might become a reliable source of financial assistance for farmers to improve nitrogen use efficiency may be limited to specific regions and/or circumstances.

### **Compliance Provisions Are Different Type of Financial Incentive**

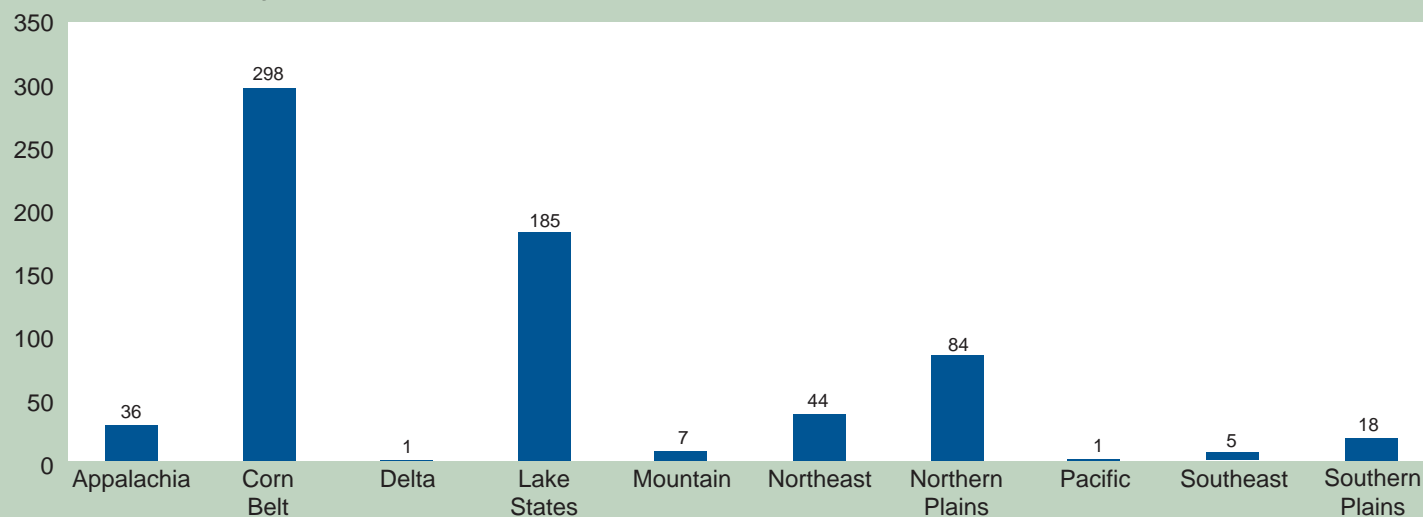
Compliance provisions require farmers to meet some minimum standard of environmental protection on environmentally sensitive land as a condition for eligibility for many Federal farm pro-





### Corn Belt needed the most nitrogen management improvement in 2006

1,000 tons excess nitrogen



Source: USDA, Economic Research Service using data from Phase II of USDA's Agricultural Resources Management Survey.

gram benefits, including conservation and commodity program payments (see “Can Commodity Program Payments Encourage Better Nutrient Management?” in the June 2007 issue of *Amber Waves*). Farmers currently face compliance provisions that address tilling highly erodible land, converting highly erodible grasslands to crop production, and converting wetlands to cropland.

In assessing the potential efficacy of using compliance to promote nitrogen management, two key questions must be considered:

- To what extent do crop producers who have the greatest potential for reducing nitrogen emissions at least cost also participate in farm programs?
- Are Government payments to these producers large enough to encourage broad adoption of practices that improve nitrogen use efficiency and reduce nitrogen emissions?

Over 97 percent of U.S. corn acres received Government payments in 2005, averaging \$51.39 per acre. This average is much higher than the average EQIP payment rate for farmers that adopt nutrient management best practices (\$8.88 per acre). However, a drawback of compliance is that the strength of the incentive is dependent on the level of Government payments. Since 2005, direct Government commodity payments have declined by 50 percent because of higher crop prices. The compliance “hook” is therefore not as strong, since farmers are less likely to worry about meeting compliance provisions during periods of high prices.

### Regulatory Restrictions on Nitrogen Use Provide More Alternatives

Regulations, such as mandatory best management practices, are generally seen as inefficient because farming is so diverse and many environmental regulations take a “one-size-fits-all” approach. On the other hand, regulations can be targeted to spe-

cific problem areas and provide a degree of certainty that environmental quality will improve. A number of States have resorted to regulation where particular environmental problems were not being addressed through other approaches. These regulations tend to require the development and implementation of a nutrient management plan. Nutrient management plans are inherently flexible in that they take into account a farm’s resource base and cropping practices; they are not “one size fits all.”

A nutrient management plan addresses the amount, source, placement, and timing of the application of plant nutrients and soil amendments. The only Federal agricultural environmental regulations involve managing manure on large confined animal feeding operations that generally have lots of manure and relatively little land to spread it on (see “Managing Manure: New Clean Water Act Regulations Create Imperative for Livestock Producers” in the February 2003 issue of *Amber Waves*). Clean

Water Act regulations require that those operations requiring a pollution discharge permit develop and implement a nutrient management plan that specifies nutrients be applied at a rate that more closely matches crop needs and lessens the risk of environmental losses.

### Farms With Animals Pose Special Problems

Livestock and poultry farms have a steady supply of nutrients in the form of manure and waste. Ideally, farmers would spread manure back on their fields to fertilize feed crops, thereby completing the cycle of fertilizer-feed-waste-fertilizer. However, many animal operations purchase feed and produce more manure nutrients than their land can appropriately utilize.

Excess manure can be sold or given away to nearby farmers as a substitute for commercial fertilizer. However, manure is more costly to apply than commercial fertilizer, its nutrient content is uncertain (unless properly tested), and it may not provide all the necessary nutrients, so many crop producers do not want to apply it to their fields. This makes it difficult and costly for livestock owners to safely dispose of their manure waste, especially for the largest operations with the most manure.

While some of the largest animal operations are currently required to implement nutrient management plans that do not allow over-application of manure, only a small percentage of animal operations are regulated. Voluntary approaches are unlikely to be effective on the remaining operations unless substantial financial assistance is

available for improved handling, storage, and hauling of manure.

### Watch Out for Tradeoffs

An important consideration in any policy aimed at reducing nitrogen's impacts on the environment is the ability of nitrogen to change chemical form and circulate throughout the environment. Focusing on a single environmental problem can exacerbate another. For example:

- Switching from surface application to incorporation/injection to reduce ammonia emissions can increase nitrate leaching and the threat to groundwater.
- Switching from fall to spring application to reduce the threat of leaching can increase the emissions of nitrous oxide, a powerful greenhouse gas.

In both cases, *total* nitrogen emissions decrease through improved management, but losses of particular nitrogen compounds can increase. Such unintended tradeoffs are important to consider when designing a nitrogen management policy. Only reducing the amount of nitrogen applied assures a reduction of *all* nitrogen compounds.  $\mathbb{W}$

### Pathways for Nitrogen Losses

**Soil erosion.** Nitrogen can be lost from the soil surface when attached to soil particles that are carried off the field by wind or water. Although erosion can be observed across all regions, wind erosion is more prevalent in dry regions and water erosion is more prevalent in humid regions. Overall, little nitrogen is lost through erosion when basic conservation practices are in place.

**Runoff.** Surface runoff can remove nitrogen in a dissolved form (generally nitrate). Runoff is only a concern when fertilizer is applied on the surface and is carried away in rainwater before it enters the soil.

**Ammonia volatilization.** Significant amounts of nitrogen can be lost to the atmosphere as ammonia if animal manure or urea is not injected or immediately incorporated into the soil. Additionally, warm temperatures can accelerate the conversion of manure and other susceptible inorganic nitrogen fertilizers to ammonia gas.

**Denitrification.** When oxygen levels in the soil are low, microorganisms called denitrifiers convert nitrate to nitrogen gas and nitrous oxide gas. Nitrogen gas is not an environmental issue, but nitrous oxide is a powerful greenhouse gas.

**Leaching.** Leaching occurs when there is sufficient rain and/or irrigation to move easily dissolvable nitrate through the soil profile. The nitrate eventually ends up in underground aquifers or in surface water via tile drains and groundwater flow.

### This article is drawn from ...

ERS Briefing Room on Environmental Interactions with Agricultural Production, available at: [www.ers.usda.gov/briefing/agandenvironment/](http://www.ers.usda.gov/briefing/agandenvironment/)

Nutrient Management chapter of the ERS Briefing Room on Agricultural Chemicals and Production Technology, available at: [www.ers.usda.gov/briefing/agchemicals/nutrientmanagement.htm](http://www.ers.usda.gov/briefing/agchemicals/nutrientmanagement.htm)



# Do Farm Programs Encourage Native Grassland Losses?

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- In the Northern Plains, a number of migratory birds use native grasslands—land that has never been cultivated for crop production—as breeding habitat. Once cultivated, native grassland habitat is difficult to restore.
- About 1 percent of Northern Plains rangeland was converted to cropland between 1997 and 2007.
- Crop insurance, marketing loan benefits, and disaster assistance can encourage farmers to cultivate more land than they otherwise would, partly at the expense of rangeland.

Federal programs may encourage farmers to convert native grasslands—land that has never been cultivated—to production of corn, soybeans, and other crops, leading to potential losses of Northern Plains' native grasslands. Federally subsidized crop insurance reduces risk associated with crops grown on converted grasslands and, over time, increases average returns to production by making crop farming more attractive. Other programs, including Federal disaster assistance and marketing loan benefits, also reduce risk and increase returns to crop production on converted grasslands. While these programs can be important risk management tools for farmers, they may also result in unintended, environmentally damaging actions.



While programs like crop insurance and marketing loans may be encouraging producers to convert grasslands to cropland, agricultural conservation programs like USDA's Conservation Reserve Program (CRP) and USDA's Environmental Quality Incentives Program (EQIP) can encourage producers to return cropland to grass cover or otherwise enhance wildlife habitats on agricultural lands (among other things). These programs may be working at cross-purposes.

A 2011 ERS report reveals that farm programs had a modest but measurable effect on cropland acreage in the Northern Plains between 1997 and 2007. Although crop insurance may impact native grassland losses, the ERS analysis indicates that marketing loan benefits and disaster payments also played a role in grassland conversion.

Farm programs, however, are only one of several factors that could encourage farmers to extend crop production into grasslands. Since 2006, crop prices have risen dramatically. Beginning in 2007, ethanol and other demand factors significantly increased corn prices. Other crop prices rose in subsequent years, as farmers shifted cropland into corn production.

New technology also plays a role. Corn hybrids and soybean varieties are increasingly drought resistant and offer herbicide tolerance—characteristics that may allow Northern Plains' producers to respond to higher crop demand.

If historically high crop prices persist, crop insurance and disaster assistance programs could continue to influence producers' land-use decisions because they focus on intra-season risk due to lower than expected crop yields or, in the case of revenue insurance, a large decline in market prices. Marketing loan benefits would not be a



Dennis Larson, USDA/NRCS

factor because benefits are not paid unless prices fall below the prevailing loan rate for each crop.

### Native Grasslands Provide Breeding Habitat

The Prairie Pothole Region (PPR) of the Northern Plains (which includes parts of Iowa, Minnesota, North Dakota, South Dakota, and Montana) is attractive to migratory birds, particularly ducks that prefer to nest in the grasslands near small wetlands or “potholes” found throughout the region. About half of all ducks born in North America come from the PPR. Other migratory birds that depend on native grasslands in the Northern Plains include the grasshopper sparrow, bobolink, Baird's sparrow, northern harrier, horned lark, loggerhead shrike, and lark sparrow.

Vegetation like grasses, forbs, and other plants thrive on the uncultivated land in the Northern Plains (see box, “Defining Grasslands”). Native grasslands also support vertebrate animals, invertebrates, and

## Defining Grasslands

Grasslands are defined by land cover and use. Grasses are the dominant vegetation, but grasslands also include legumes, forbs, and other vegetation. Grassland use includes such activities as grazing, haying, and other forms of forage harvest. Based on these criteria, grasslands encompass minimally managed native grass rangeland, domestic grass or legume pastures, and hay crops that may be intensively managed. Conservation Reserve Program (CRP) land in grass cover—a large majority of CRP land in the Northern Plains—is also considered grasslands.

Unfortunately, native grassland conversion cannot be precisely quantified because existing data do not identify grasslands as native or nonnative. (Native grasslands are also referred to as “native sod.”) Native grasslands are usually classified as rangeland based on native vegetation. Rangeland is not necessarily native grassland, however, because native species can be reseeded. Nonetheless, if farm programs encourage rangeland to cropland conversion, they also are likely to encourage native grassland conversion.

soil microorganisms important to native grassland habitats. While grasses can be reseeded, once the land has been cultivated, the full diversity of these habitats is difficult to re-establish. However, grasslands established under the CRP have been observed to support numerous bird species, and CRP grasslands have been documented to increase duck and grassland bird populations.

### Land Moves Between Cropland and Other Uses

The Northern Plains represents a transitional zone between the humid East, where tall grass prairies once flourished, and the arid West, where grassland still dominates the landscape. Because of this unique geography, a significant share of the remaining grasslands in the Northern Plains is productive enough for crop production under favorable economic and policy conditions.

Agricultural producers make decisions to convert native grasslands to crop production within the context of their overall farming or ranching operations. From a market perspective, the value of grasslands is derived primarily from livestock forage. The value of native grass for wildlife habitat and other ecological services may be important to society at large but cannot fully accrue to producers.

Moreover, farmers and ranchers have other forage production options, including nonnative grass pastures, reseeded native grasses, and hay. Converting native grasslands to crop production becomes part of a broader set of land-use decisions about forage and field crop production.

In the Northern Plains, many producers also consider enrolling marginal cropland in the CRP when making land-allocation decisions. Between 1997 and 2007, land moved

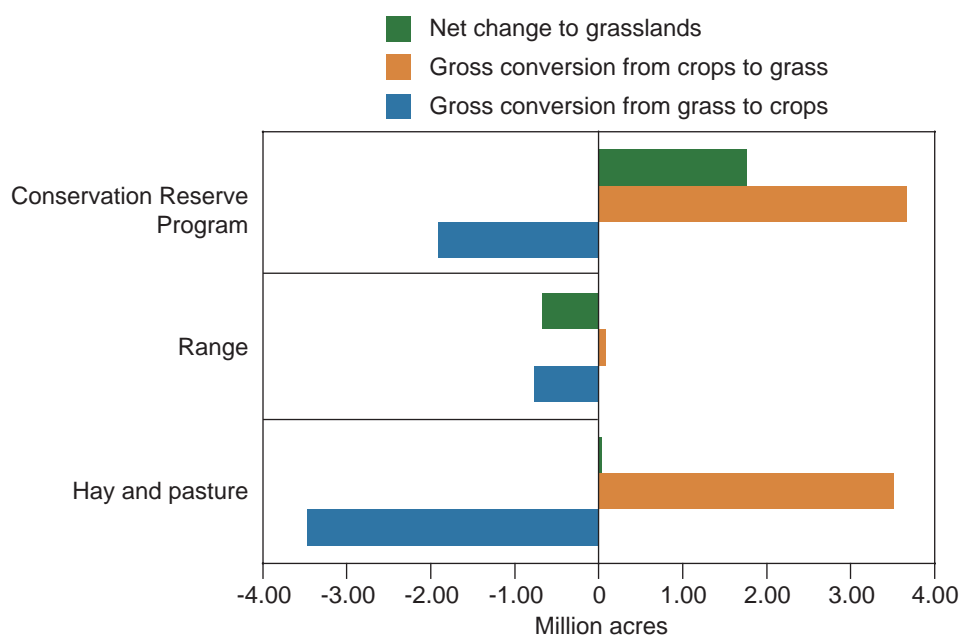
between cultivated crops, rangeland, hay, pasture, and the CRP.

Compared with producers in other regions, producers in the Northern Plains (specifically Kansas, Nebraska, South Dakota, and North Dakota) were more likely to convert rangeland to cropland. The Northern Plains accounted for 57 percent of U.S. *gross conversions* of rangeland to cropland in 1997-2007, even though the region encompasses only 18 percent of the Nation's rangeland. Roughly 770,000 acres of Northern Plains' rangeland were converted to cropland—about 1 percent of the region's rangeland in 1997. The *net conversion* from rangeland to cropland (gross conversion minus conversions of cropland to rangeland) in the Northern Plains was about 680,000 acres, implying that only a small amount of land was shifted from cultivated crops to rangeland. In every other

region where rangeland is found (mostly in Western States), cultivated crop to rangeland conversion exceeded rangeland to cultivated crop conversion, resulting in a net shift from cultivated cropland to rangeland.

In addition to rangeland conversions, a relatively large amount of acreage tends to rotate between hay or pasture and cultivated crops. Between 1997 and 2007, Northern Plains' producers moved 3.5 million acres of hay and pasture (23 percent of the region's 1997 acreage) to cultivated crops, while moving roughly the same number of acres from cultivated crops to hay or pasture. So there was no net shift of land between cultivated crops and hay/pasture in the Northern Plains. In every other U.S. region, however, producers moved more land from cultivated cropland to hay or pasture than they moved from hay or pasture to cultivated crops, creating a net shift of cultivated cropland to hay

**Hay and pasture accounted for largest share of grassland-cropland conversion in the Northern Plains, 1997-2007**



Source: USDA, Economic Research Service using data from the National Resources Inventory.



or pasture that equaled 4-10 percent of 1997 hay and pasture acreage.

Interaction with the CRP did decrease cultivated cropland and increase hay and pasture in the Northern Plains. Between 1997 and 2007, Northern Plains' producers enrolled 3.6 million acres of cropland in the CRP for the first time. During the same period, 1.9 million acres withdrawn from the CRP were returned to crop production and another 1.7 million acres of CRP land became hay, pasture, or rangeland.

### Some Federal Programs Reduce Risk and Increase Average Returns

Cropland recently converted from grasslands does not qualify for all USDA programs and payments. Since 1996, many Federal agricultural payments have been “decoupled” from current production, meaning that changes in production, such as a change in crop acreage, cannot change the payment received from these programs. Farmers cannot

increase decoupled payments if they make decisions that impact current crop production, including grassland to cropland conversion (nor do they lose decoupled payments if crop production is stopped).

Some payments, however, are still tied to current production. Crops grown on converted grasslands are eligible for crop insurance indemnities (with the payment of premiums that are highly subsidized by the Federal Government), disaster assistance payments, and marketing loan benefits. Crop insurance reduces crop production risks because indemnities are paid when yield or crop revenue drops below a “guarantee level,” typically the product of expected revenue (the producer's average yields in recent years multiplied by expected crop prices just prior to planting time) and the level of coverage purchased by the producer. The most popular coverage levels—65, 70, and 75 percent of expected revenue—carry

premium subsidies of 55 percent or more. Because producers pay less than half of the full premium, crop insurance increases average crop revenue over time.

Marketing loans offer similar protection against low prices. Marketing loan benefits are triggered when the price of a covered crop falls below a legislatively established loan rate. For example, when farmers sell corn for less than the loan rate of \$1.95 per bushel for corn, the Federal Government makes up the difference.

Disaster assistance payments have been authorized by Congress on an ad hoc basis. Disaster payments were made every year between 1985 and 2007, totaling more than \$30 billion. The 2008 Farm Act included a standing disaster assistance payment program—the Supplemental Revenue Assistance Payments Program—intended to replace ad hoc disaster payments.

Payments from these programs varied between 1997 and 2007, peaking in 1999-2001 when payments in the Northern Plains equaled 30 percent or more of the market value of crop production (not including the effect of subsidized producer-paid crop insurance premiums). Marketing loan benefits spiked in 1999-2001, largely due to payments for soybeans. The pre-2002 soybean loan rate was \$5.26 per bushel, while season average prices hovered around \$4.50 for 1999-2001. Since 2007, corn, soybean, and wheat prices have been above their respective loan rates.

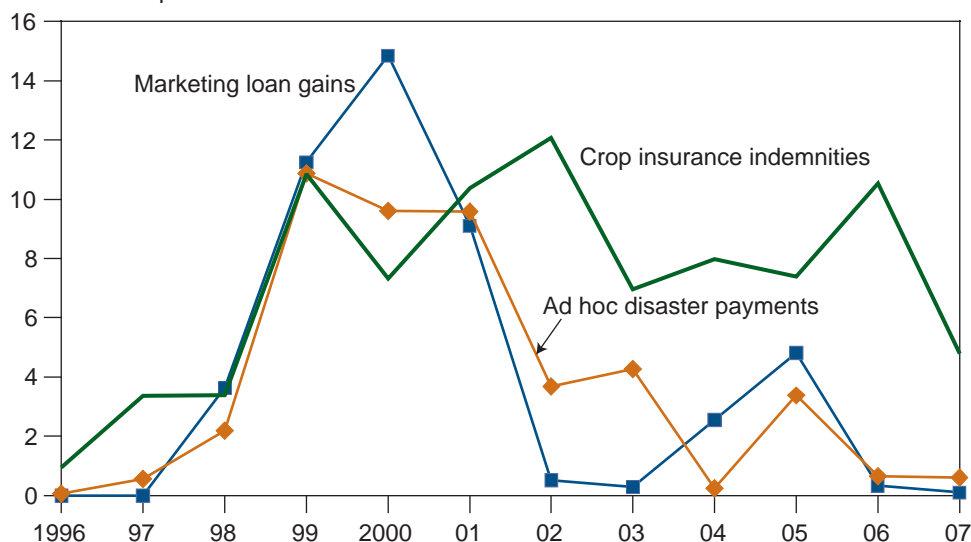
Crop insurance indemnities increased sharply in 1999, partly as a result of higher premium subsidies that triggered broader crop insurance program participation. Congress mandated higher premium subsidies beginning in 1999 to increase crop insurance participation. Ad hoc disaster assistance payments also surged in 1999,



Tim McCabe, USDA/NRCS

## Farm programs accounted for a substantial share of crop revenue in the Northern Plains

Percent of crop revenue



Source: USDA, Economic Research Service using data from USDA's Agricultural Resources Management Survey.

although disaster payments tend to lag actual crop disasters by 1-2 years.

Except for 1999, crop insurance indemnities appear to be more stable (paid out more regularly) over time than marketing loan benefits, partly due to the structure of the programs. Marketing loan benefits are triggered only when prices fall below fixed loan rates. In recent years, crop prices have been well above their respective loan rates. In contrast, crop insurance can protect producers against unexpectedly low yields or, in the case of crop revenue insurance, an unexpectedly large intra-season drop in crop prices. Even when crop prices are quite high, crop revenue insurance reduces the risk of unexpectedly low revenue.

How program-induced revenue changes translate into land-use changes depends, in part, on the amount of grasslands that can support crop production. In the Northern Plains, most high-productivity land is used for cultivated crops (80 percent), while most low-productivity land is rangeland used for grazing (73 percent). Medium-productivity land is spread across all uses, including cultivated crops (53 percent), hay and pasture (10 percent), range (32 percent), and CRP (5 percent), implying that returns to medium-productivity land are similar across land uses, although landowners may differ on the most valuable use. In the Northern Plains, roughly 35 percent of rangeland was defined as medium productivity, indicating that the potential for rangeland to cropland conversion is large, given favorable economic and policy conditions.

Grassland Acreage Would Have Been Larger Without Farm Programs

A 2011 ERS study estimated the overall effect of crop insurance, marketing loan benefits, and disaster assistance on

land use during 1997-2007 in a 77-county region of the Northern Plains covering much of South Dakota and the southern half of North Dakota. This 77-county region captures the diverse soil and climatic conditions found in the Northern Plains, stretching from the western Corn Belt to the semi-arid ranchlands in the west.

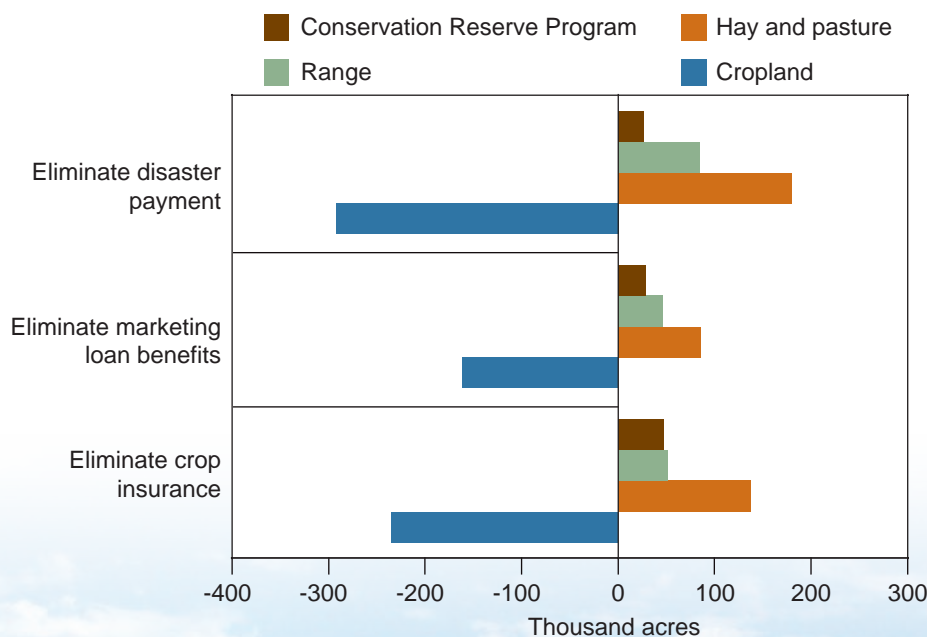
Researchers used a statistical model to estimate the effect of crop revenue, including from farm programs, on land allocation across four uses: cultivated cropland, hay and pasture, rangeland, and CRP. Overall, crop insurance, marketing loans, and disaster assistance were estimated to increase cropland acreage by almost 3 percent, on average, over what it would have been without these programs during 1997-2007. Crop insurance increased cropland acreage by 1 percent during the same period, while marketing loan benefits and disaster payments increased cropland acreage by 0.7 percent and 1.25 percent, respectively.

The analysis also shows that most of the land needed to maintain the larger area of cropland would otherwise have been used as hay or pasture. In the absence of these programs, hay and pasture acreage would have been roughly 5 percent larger during 1997-2007. A smaller number of acres would have come from rangeland and CRP. Rangeland acreage was about 1 percent less than it would have been without all three farm programs. In the absence of crop insurance alone, rangeland area would have averaged about 0.3 percent larger.

If the three farm programs were modified to reduce their effect on land use, farmers could adjust to a lower level of cropland acreage by reducing grassland to cropland conversion or increasing crop-



# For 1997-2007, farm programs had the largest effect on hay/pasture acreage in the study region



Source: USDA, Economic Research Service using data from the National Resources Inventory (NRI).

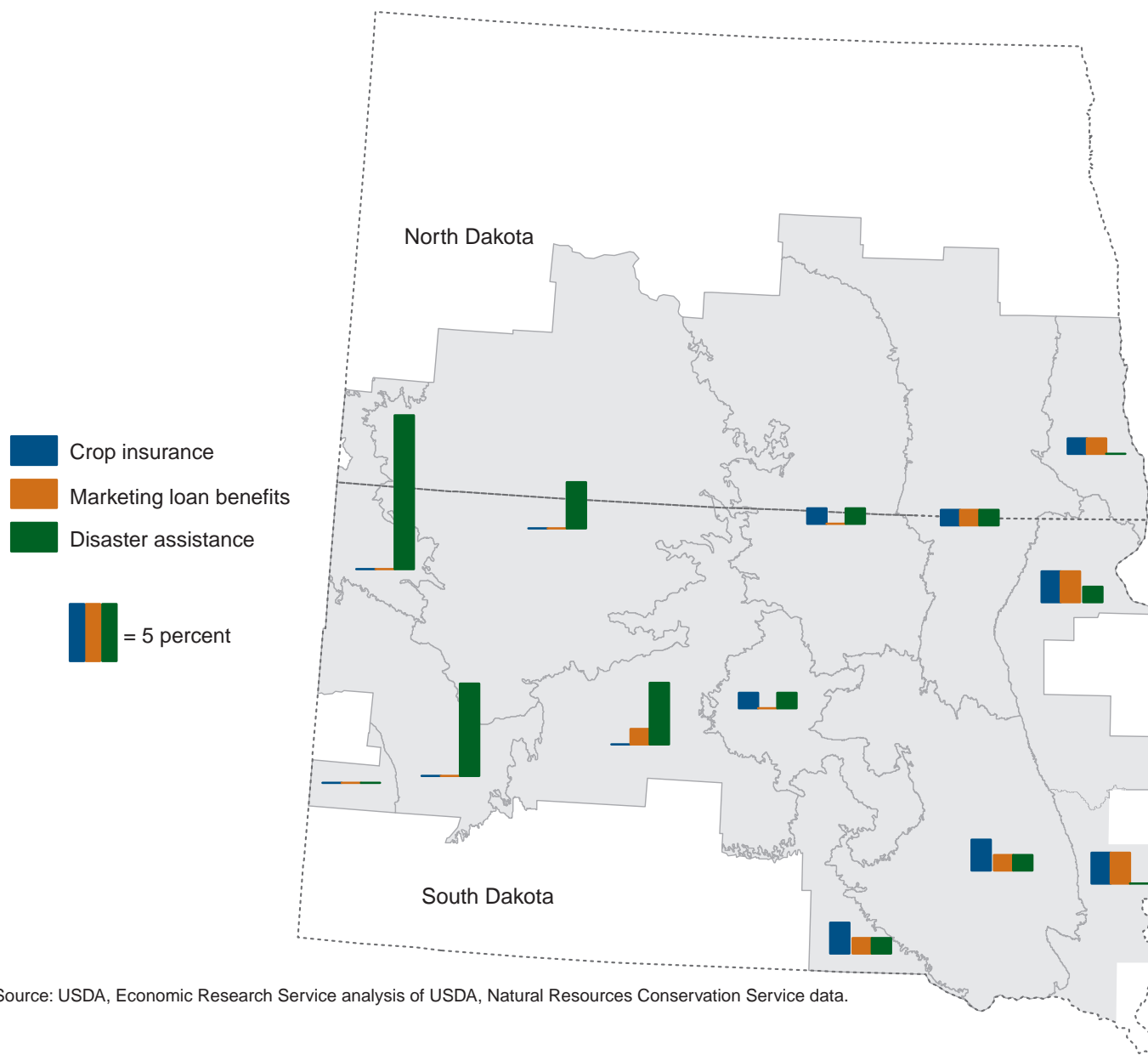
land to grassland conversion rates. Either approach is plausible, given that land moved in both directions between cropland and grasslands during 1997-2007. A majority of these changes are likely to be accomplished by altering conversion between cropland and hay or pasture.

The size and source of acreage effects varied within the 77 counties studied. The crop insurance effect was spread over central and eastern portions of the study area but was very small in the west. The largest effects from marketing loan benefits were seen in the east, where corn and soybeans are widely grown. Fewer effects were seen in the west, where wheat is the dominant crop on (nonirrigated) cultivated land and yields are relatively low. Disaster payments had a large effect in western areas but very little effect in the east. Disaster payments often require county-wide disaster declarations, which are more common in areas where rainfall is marginal for crop production, as in the western portions of the study area.

## Program Rules Could Be Changed To Reduce Land Conversions

Withholding farm program payments on native grasslands that have been converted to cropland could slow native grassland conversion. While crop insurance has been the focus of much recent concern regarding these conversions, ERS analysis indicates that marketing loan gains and disaster assistance also played a significant role. Other factors, such as high crop prices (particularly since 2007) and technological advances are also contributing to grassland conversion.

## Cropland acreage effects varied within the study region



Source: USDA, Economic Research Service analysis of USDA, Natural Resources Conservation Service data.

Under the Swampbuster provision, farmers who drain wetlands may lose nearly all farm program payments on the farm's entire operation—not just on drained acres. Although crop insurance is not currently subject to Swampbuster sanctions, producers potentially could lose direct payments, countercyclical

payments, marketing loan benefits, CRP payments, and other program benefits if they drain wetlands to increase crop production. If protection of native grasslands is an important policy objective, similar provisions could provide a strong disincentive to grassland conversion. *W*

### This article is drawn from . . .

*Grassland to Cropland Conversion in the Northern Plains: The Role of Crop Insurance, Commodity, and Disaster Programs*, by Roger Claassen, Fernando Carriazo, Joseph C. Cooper, Daniel Hellerstein, and Kohei Ueda, ERR-120, USDA, Economic Research Service, June 2011, available at: [www.ers.usda.gov/publications/err120/](http://www.ers.usda.gov/publications/err120/)





# Winner Takes (Almost) All

## How WIC Affects the Infant Formula Market

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- ERS estimates that 57-68 percent of all infant formula sold in the United States in 2004-06 was purchased through WIC.
- When a State switches its WIC contract to a different manufacturer, the market share of the new brand increases dramatically.
- Most of the increase in market share is the direct effect of recipients purchasing the new WIC brand, but spillover effects also boost sales of the brand to non-WIC customers.

USDA's Special Supplemental Nutrition Program for Women, Infants, and Children—commonly known as WIC—is the largest purchaser of infant formula in the United States. Each State awards a sole-source contract to a formula manufacturer to provide its product to WIC participants. As a result, WIC participants can only redeem their WIC voucher for formula made by the manufacturer that holds the contract for that State.



In exchange for this exclusive sales arrangement, the manufacturer provides the WIC State agency with a rebate for each can of formula purchased through the program. The rebates are large. ERS estimated that among contracts in effect in December 2008, rebates averaged about 85 percent of the wholesale price (see box, “Rebates Allow More People To Participate in WIC”). In other words, WIC paid only 15 percent of the wholesale price for formula. Why do formula manufacturers give WIC such large rebates? What are the impacts of sole-source contracts on infant formula manufacturers? A recent study by ERS researchers helps answer these questions.

### Infant Formula Market Is Highly Concentrated

In 2008, three manufacturers accounted for almost 98 percent of all U.S. formula sales: Abbott, the manufacturer of Similac, had a 43-percent share of the market; Mead Johnson, maker of Enfamil, 40 percent; and Nestlé (now Gerber), maker of Good Start, 15 percent. Since the mid-1990s, these three firms have been the sole infant formula manufacturers awarded WIC contracts.

Almost two-thirds of all formula sales are at supermarkets and supercenters (mass merchandisers with full supermarkets). The remainder is sold in drug stores, convenience stores, mass merchandisers, warehouse clubs, online, and other outlets.

Infant formula comes in different forms (powder, liquid concentrate, and ready-to-feed), bases (milk, soy, and other), and container sizes. Milk-based formula in powder form is the primary type of formula purchased by both WIC and non-WIC consumers, accounting for 72 percent of all dollar sales. All milk-

based powder formula purchased through WIC is sold in 12-16 oz containers. This formula type and container size accounts for about 55 percent of all formula sales. Milk-based powder in non-WIC size containers (smaller than 12 oz or larger than 16 oz) accounts for about 17 percent of all formula sales.

### WIC Significantly Impacts the Infant Formula Market

ERS analysis of the infant formula market using 2004-09 scanner data from over 7,000 supermarkets in 30 States revealed that the WIC contract brands accounted for 92 percent of supermarket sales of milk-based powder formula in 12-16 oz containers by the three major manufacturers. WIC contract brands accounted for 51 percent of all sales of milk-based powder formula in non-WIC sizes.

Between January 2005 and April 2008, 30 States switched to a different manufacturer as exclusive provider of

formula for the State's WIC participants. The switches provided “before” and “after” sales data, allowing a better understanding of the impact of WIC's sole-source contracts on infant formula sales in supermarkets.

ERS researchers compared each manufacturer's market share in a State in the 52 weeks prior to the contract change with its market share in weeks 13-52 after the contract change. Because WIC State agencies can issue food vouchers up to 3 months in advance, there is a transition period when WIC recipients switch to the new contract brand of formula. All WIC vouchers redeemed after about 12 weeks should reflect the new contract brand. As a result, weeks 0-12 were excluded to account for the transition period.

California—the State that serves the largest number of WIC infants—switched its WIC contract brand from Abbott to Mead Johnson in August 2007. The impact



USDA/ERS

## Rebates Allow More People To Participate in WIC

WIC serves low-income pregnant, postpartum, and breast-feeding women, infants, and children up to age 5 who are at nutritional risk. In fiscal year 2010, WIC served 9.2 million participants per month, including over half of all infants born in the United States. Federal program costs for WIC were \$6.8 billion in fiscal year 2010.

In addition to nutrition education and referrals to health and other social services, WIC provides participants (or their caregivers) with vouchers, checks, or Electronic Benefit Transfer (EBT) cards to redeem at no cost for specific supplemental foods at nearly 49,000 authorized retail foodstores nationwide. Mothers participating in WIC are encouraged to breastfeed their infants if possible, but State WIC agencies provide formula (the equivalent of up to 31 cans of 13-oz cans of liquid concentrate per month) to mothers who choose to use it.

Each WIC State agency operates its own infant formula rebate program and is responsible for negotiating rebate contracts with infant formula manufacturers (some States form multistate alliances to enter into a single rebate agreement). As a result, the conditions of the contract—including the amount of the rebate, the contract term, and the manufacturer that holds the contract—will vary across States. These sole-source contracts are awarded on the basis of competitive bids: the firm offering

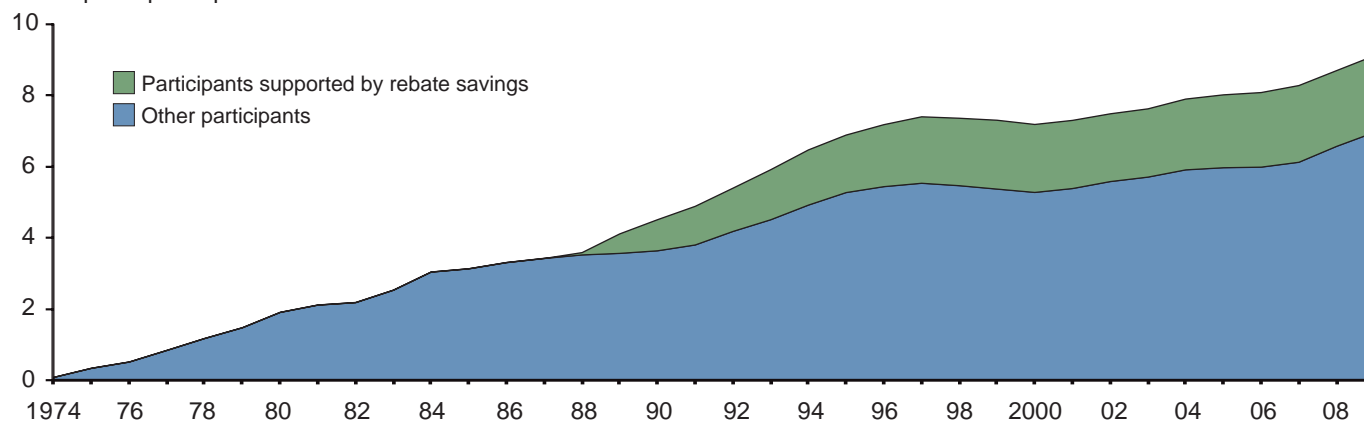
the lowest net wholesale price (equal to the manufacturer's wholesale price minus the rebate) wins the WIC contract. WIC State agencies generally rebid their infant formula rebate contracts every 4 years. In many States, the manufacturer—and thus the brand of formula provided through WIC—changes from contract to contract.

WIC State agencies reimburse retailers the full retail price of the formula purchased with WIC vouchers. The WIC State agency then requests a rebate reimbursement from the manufacturer. As a result, the actual cost to WIC for each can of infant formula sold through the program is equal to the retail price minus the manufacturer's rebate.

Rebates are a major source of funds for WIC. In fiscal year 2009, WIC received \$1.9 billion in rebates from infant formula manufacturers. Unlike entitlement programs, such as the Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program), that guarantee assistance to all eligible applicants, WIC is a discretionary grant program funded annually by Congress that provides assistance to as many qualified applicants as funding allows. The savings generated by rebates provide benefits to additional participants within the same total budget. In recent years, rebates have supported almost a quarter of the WIC caseload.

**Savings from infant formula rebates supported almost one-quarter of WIC's caseload in fiscal year 2009**

Million participants per month



Note: The WIC program started in fiscal year 1974, and the infant formula rebate program started in fiscal year 1988.

Source: USDA, Economic Research Service calculations based on USDA, Food and Nutrition Service data.



of this change on market shares of milk-based powder in 12-16 oz containers was dramatic. Abbott's market share in the State fell from about 90 percent in the year before the contract change to about 5 percent in the year after the change. On the other hand, Mead Johnson's market share increased from about 5 percent to about 95 percent.

ERS researchers found that the benefits of holding the WIC contract "spill over" to non-WIC purchases. In California, Abbott's decline in market share for milk-based powder in non-WIC sizes was almost completely offset by Mead Johnson's increase in market share. Since all non-WIC sized containers are purchased outside of WIC, there is no transition period. Rather, after the contract changes, non-WIC sized containers saw a steady increase in market share for the new contract holder over time and a decrease in market share for the former contract brand.

ERS researchers found similar effects on market shares across the 30 States. For milk-based powder in 12-16 oz containers, the market share of the new WIC contract brand manufacturer increased by an average 84 percentage points across the 30 States. The market share of the former contract holder decreased by almost the same amount—83 percentage points—after losing the contract. The market share of the third manufacturer—the one that did not hold the WIC contract during either period—decreased by less than 1 percent.

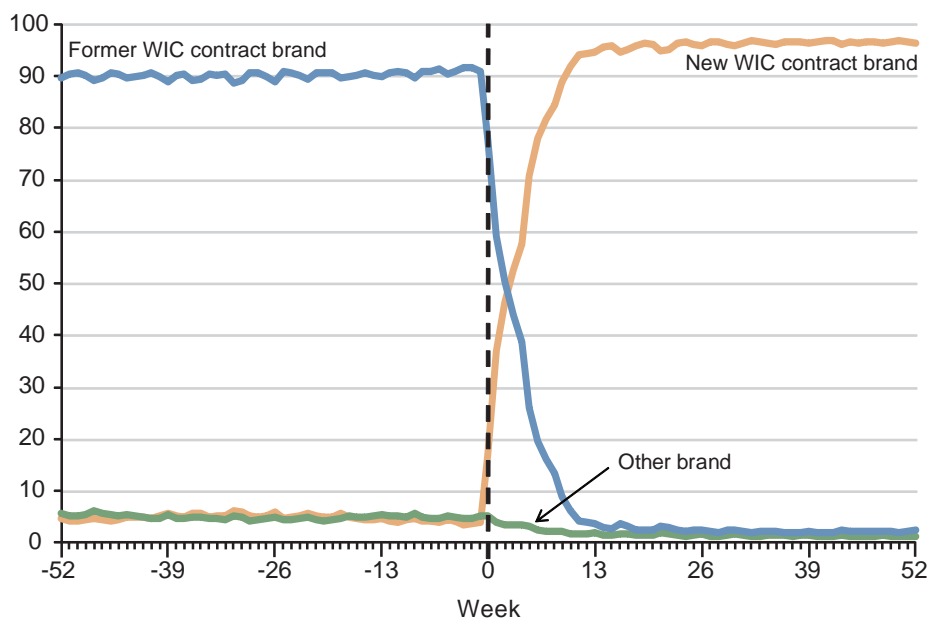
As in California, manufacturers that won the WIC contract also saw increased spillover formula sales in non-WIC sized containers. In the 30-State analysis, the manufacturer that won the WIC contract experienced an average 18-percentage-



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**In California, the market share of the new WIC formula brand jumped to 95 percent following August 2007 contract change**

Market share for 12-16 oz milk-based powder (percent)

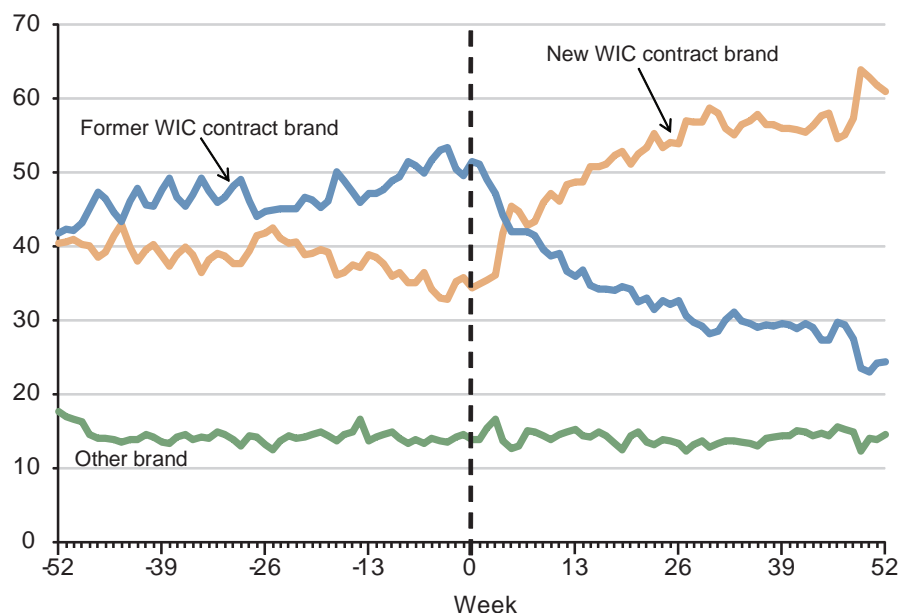


Notes: The week the contract changed was designated as week 0 (indicated by the dashed line), and the other weeks were numbered sequentially from that point. For example, week -26 refers to 26 weeks *prior* to the change and week 26 refers to 26 weeks *after* the change.

Source: USDA, Economic Research Service calculations based on Nielsen supermarket scanner data.

### Even for formula in non-WIC sizes, market shares in California responded when the WIC brand changed in August 2007

Market share for milk-based powder in other than 12-16 oz containers (percent)



Notes: The week the contract changed was designated as week 0 (indicated by the dashed line), and the other weeks were numbered sequentially from that point. For example, week -26 refers to 26 weeks *prior* to the change and week 26 refers to 26 weeks *after* the change.

Source: USDA, Economic Research Service calculations based on Nielsen supermarket scanner data.

point increase in market share of formula in non-WIC sizes, while the manufacturer that lost the contract experienced an average 19-percentage-point decrease in market share. The market share of the third manufacturer showed little change.

### Spillover Effects Can Occur for a Variety of Reasons

The indirect effects from winning the WIC contract, namely increased sales of formula not purchased with WIC vouchers, are especially lucrative for manufacturers because they do not pay a rebate on formula purchased outside of WIC. As a result, manufacturers' revenues per can for non-WIC formula in 2008 were, on average, over six times greater than those for formula purchased through WIC.

A manufacturer of the WIC contract brand can realize spillover effects in non-WIC purchases in a number of ways. Since WIC infants account for a large portion of infant formula consumers, retailers will devote more shelf space and better product placement to the WIC contract brand, resulting in increased product visibility that may spur sales to non-WIC consumers. Furthermore, WIC-authorized stores are required to maintain a minimum stock of the WIC contract brand. Smaller grocery stores have limited shelf space and, as a result, may stock only one brand of formula—the WIC contract brand. Non-WIC patrons of these stores have limited options and may purchase the WIC contract brand rather than shop for a non-WIC brand at a different store.

Sales also may rise if physicians recommend the WIC contract brand to all formula-feeding patients to avoid having to differentiate between those



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enrolled and those not enrolled in WIC. Similarly, some hospitals may provide the WIC brand of formula to all new formula-feeding mothers so that WIC mothers will not have to switch formulas once they leave the hospital.

To the degree that the quantity of formula provided by WIC does not meet all of their infant's formula needs, mothers of WIC infants may be reluctant to introduce a different brand of formula to their infants, supplementing their WIC-provided formula by purchasing the same brand out of pocket. WIC recipients who are satisfied with the WIC contract brand of formula may recommend the brand to their non-WIC friends and relatives—another spillover scenario.

### Results Explain Why Manufacturers Can Offer Large Rebates

There are several possible reasons for the sizeable rebates offered by the formula manufacturers. Winning the WIC contract assures large-volume sales to the

manufacturer, including higher volumes of the more profitable non-WIC sales.

Formula manufacturers have large manufacturing plants, and operating these plants at less than the optimal level is inefficient, leading to higher per unit costs. Winning the WIC contract, especially for a larger State or a multistate alliance, can have a considerable impact on the manufacturer's ability to operate at or near optimal capacity.

Food and beverage manufacturers pay a variety of fees and payments to food retailers so they will carry their product. The formula manufacturer with the WIC contract has a stronger bargaining position, especially with regard to WIC-authorized stores. The manufacturer may be able to negotiate lower fees than the other formula manufacturers because of the large volume of sales associated with the WIC contract brand.

As a result, manufacturers that operate at less than optimal levels or that want to keep production levels high and face expiring contracts have an incentive

to bid aggressively on new contracts. Furthermore, because formula volume sales have been decreasing over time, formula manufacturers are competing for a shrinking market, making winning WIC infant formula contracts even more important. **W**

#### This article is drawn from . . .

*The Infant Formula Market: Consequences of a Change in the WIC Contract Brand*, by Victor Oliveira, Elizabeth Frazão, and David Smallwood, ERR-124, USDA, Economic Research Service, August 2011, available at: [www.ers.usda.gov/publications/err124/](http://www.ers.usda.gov/publications/err124/)

*Rising Infant Formula Costs to the WIC Program: Recent Trends in Rebates and Wholesale Prices*, by Victor Oliveira, Elizabeth Frazão, and David Smallwood, ERR-93, USDA, Economic Research Service, February 2010, available at: [www.ers.usda.gov/publications/err93/](http://www.ers.usda.gov/publications/err93/)

#### You may also be interested in . . .


*The WIC Program: Background, Trends, and Economic Issues, 2009 Edition*, by Victor Oliveira and Elizabeth Frazão, ERR-73, USDA, Economic Research Service, April 2009, available at: [www.ers.usda.gov/publications/err73/](http://www.ers.usda.gov/publications/err73/)

ERS Briefing Room on the WIC Program, available at: [www.ers.usda.gov/briefing/wic/](http://www.ers.usda.gov/briefing/wic/)



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Get a spatial overview of low-income neighborhoods with high concentrations of people who are far from a grocery store.

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# Where Did the Corn Come From To Fuel the Expansion in Ethanol Production?

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Between 2000 and 2009, U.S. ethanol production increased from 1.6 billion gallons to 10.8 billion gallons, almost all of which was produced from corn. While some of the corn came from increased yields and some was diverted from other uses, much of the corn needed to produce ethanol came from expanding planted acreage. Between 2000 and 2009, U.S. corn production increased from 9.9 billion bushels grown on 72.4 million acres to 13.1 billion bushels grown on 79.5 million acres.

This period of rapid change is reflected in both aggregate (national, State, and county) and farm-level data on crop acreage. To see this, ERS researchers looked at large-scale changes in land use at the national level and more disaggregated changes at the State and county levels before examining individual farm-level changes. The farm-level changes, captured in a special version of USDA's Agricultural Resource Management Survey (ARMS), provide important insight not evident

in the more aggregated data about how producers expanded corn acreage.

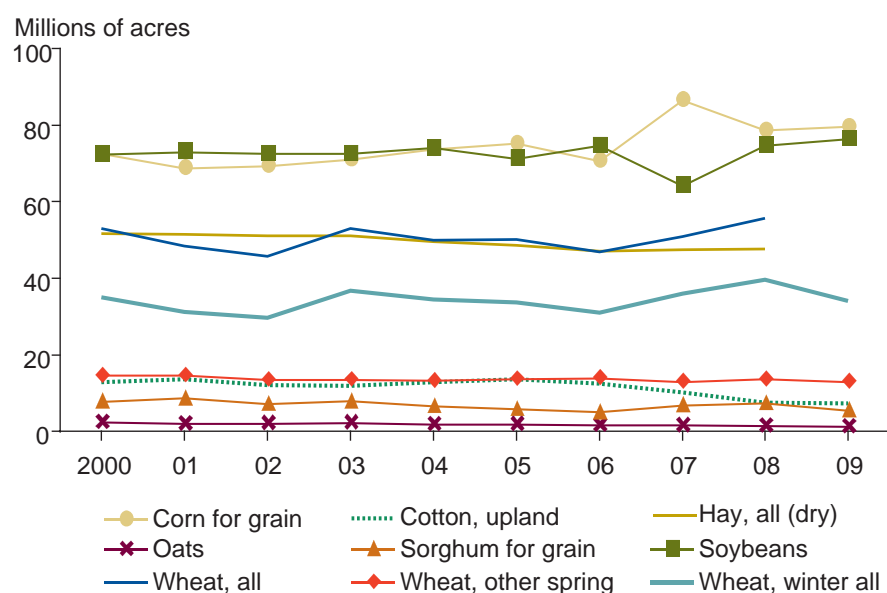
National-level data show that between 2006 and 2007, a large increase in corn acreage was accompanied by a sizable decrease in soybean acreage, but this shift largely reversed between 2007 and 2008. Over the long run, there is not an obvious historical shift out of soybeans into corn. Both corn and soybean acreage increased over the past decade.

## Regional Differences May Explain Why Total Soybean Acreage Did Not Decrease Between 2006 and 2008

Looking at State-level changes in harvested corn and soybean acreage, several States—most notably Illinois, Iowa, and Minnesota—showed large increases in corn acreage with proportional decreases in soybean acreage. Nebraska and North Dakota had large increases in corn acreage accompanied by much smaller reductions in soybean acreage. Other States—South Dakota, Kansas, Mississippi, and Arkansas—had increased corn and soybean acreage. Regional differences suggest that not all increases in corn acreage came out of soybeans.

In addition to shifting acreage between crops, farms can also increase total harvested acreage by expanding cropland or by increasing double cropping—the practice of harvesting two crops from the

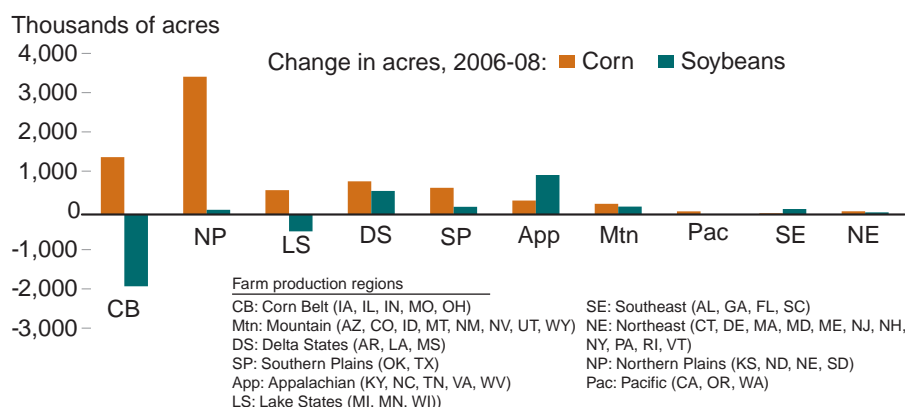
### Both corn and soybean acreage increased nationally



Notes: Changes in harvested acreage for major crops illustrate possible shifts between crops over time but may also reflect other changes such as conversion of pasture to cropland or increases in double cropping.

Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service's Crop Production Summaries.

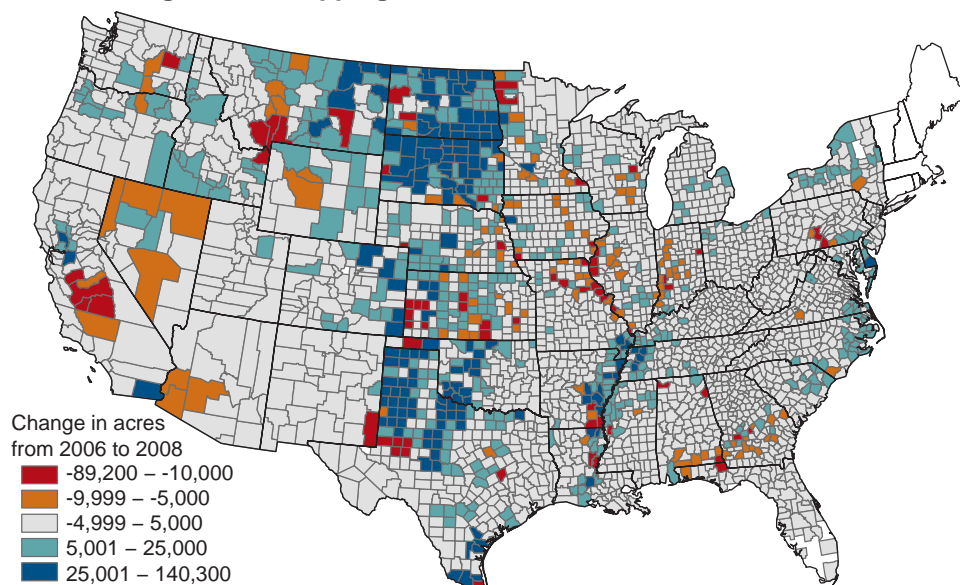
## Regional differences suggest that not all increases in corn acreage came out of soybeans



Note: Comparing changes in harvested acreage at a finer geographic scale provides a better indication of whether farmers were shifting land between crops.

Source: USDA, Economic Research Service using USDA, National Agricultural Statistics Service's Crop Production Summaries.

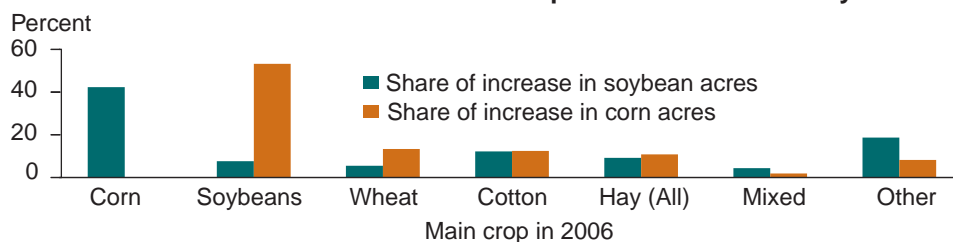
## Farms increased total harvested acreage by expanding cropland or increasing double cropping



Note: Counties in blue increased the sum total of harvested acreage for major crops either by bringing additional land into crop production or by expanding double cropping. Counties in gray had approximately the same harvested acreage. Harvested acreage declined in counties in red and orange.

Source: USDA, Economic Research Service calculations based on USDA, National Agricultural Statistics Service's Crop Production Summaries.

## Which farms contributed the most to the expansion of corn and soybeans?



Source: USDA, Economic Research Service using Bioenergy Version of USDA's Agricultural Resource Management Survey, 2008.

same field in the same year. County-level data show where growth in total harvested acres occurred during the rapid runup in ethanol production.

Outside of the Corn Belt, many counties increased total harvested acres between 2006 and 2008. The question that is difficult to answer without farm-level data: How did farms in these counties increase total harvested acreage?

## Shifts From Soybeans to Corn Were Offset by Shifts to Soybeans

Using a unique farm-level dataset (the 2008 Bioenergy Version of ARMS), ERS researchers compared the planting decisions of farms growing corn or soybeans in 2008 with those in 2006 to measure responses to changing market demand. To understand how different types of farms responded to increased demand for corn, ERS researchers divided farms into groups based on their dominant crop in 2006. Farms that had more than 50 percent of their planted acreage in corn in 2006 were classified as corn farms.

Other farms were classified based on the dominant noncorn crop grown in 2006 (with dominance assigned if a single crop accounted for more than 33 percent of non-corn acreage on the farm). Based on this classification, farms that primarily grew soybeans in 2006 were the main source of new corn acres. However, there was not a net decrease in soybean acres. Reductions in acreage of other crops, as well as an expansion in harvested acres, have been important sources for the simultaneous expansion of corn and soybean production.

This article is drawn from . . .

*The Ethanol Decade: An Expansion of U.S. Corn Production, 2000-2009*, by Steven Wallander, Roger Claassen, and Cynthia Nickerson, EIB-79, USDA, Economic Research Service, August 2011, available at: [www.ers.usda.gov/publications/eib79/](http://www.ers.usda.gov/publications/eib79/)



Data may have been updated since publication. For the most current information, see [www.ers.usda.gov/publications/agoutlook/aotables/](http://www.ers.usda.gov/publications/agoutlook/aotables/)

## Farm, Rural, and Natural Resource Indicators

	2007	2008	2009	2010	2011	Annual percent change			
						2007-08	2008-09	2009-10	2010-11
Cash receipts (\$ bil.)	288.5	318.3	283.4	312.3f	340.7f	10.3	-11.0	10.2	9.1
Crops	150.1	176.8	163.7	170.9f	194.9f	17.8	-7.4	4.4	14.0
Livestock	138.5	141.5	119.8	141.5f	145.8f	2.2	-15.3	18.1	3.0
Direct government payments (\$ bil.)	11.9	12.2	12.3	12.2f	10.6f	2.5	0.8	-0.8	-13.1
Gross cash income (\$ bil.)	318.0	352.0	317.6	345.6f	372.5f	10.7	-9.8	8.8	7.8
Net cash income (\$ bil.)	77.7	90.4	69.1	91.3f	98.6f	16.3	-23.6	32.1	8.0
Net value added (\$ bil.)	117.2	136.6	112.1	129.0f	147.4f	16.6	-17.9	15.1	14.3
Farm equity (\$ bil.)	1,841.2	1,780.6	1,811.8	1,880.8f	2,008.8f	-3.3	1.7	3.8	6.8
Farm debt-asset ratio	10.4	12.0	11.9	11.3f	10.7f	15.4	-0.8	-5.0	-5.3
Farm household income (\$/farm household)	88,796	79,796	77,169	83,021f	86,352f	-10.1	-3.3	7.6	4.0
Farm household income relative to average U.S. household income (%)	131.3	116.6	113.5	na	na	na	na	na	na
Nonmetro-metro difference in poverty rate (% points) <sup>1</sup>	3.5	2.2	2.7	na	na	na	na	na	na
Cropland harvested (million acres)	312	316	310	315p	na	1.3	-1.9	1.6	na
USDA conservation program expenditures (\$ bil.) <sup>1,2</sup>	4.5	5.2	4.9	5.7	6.2p	15.6	-6.0	16.1	8.7

## Food and Fiber Sector Indicators

U.S. gross domestic product (\$ bil.)	14,062	14,369	14,119	14,698f	na	2.2	-1.7	4.1	na
Share of agriculture & related industries in GDP (%) <sup>1</sup>	4.6	4.6	4.6	4.6f	na	na	na	na	na
Share of agriculture in GDP (%) <sup>1</sup>	0.8	0.9	0.7	0.9f	na	na	na	na	na
Total agricultural imports (\$ bil.) <sup>2</sup>	70.1	79.3	73.4	79.0	88.0f	13.1	-7.4	7.6	11.4
Total agricultural exports (\$ bil.) <sup>2</sup>	82.2	114.9	96.3	108.7	135.5f	39.8	-16.2	12.9	24.7
Export share of the volume of U.S. agricultural production (%) <sup>1</sup>	21.8	21.7	19.8f	21.0f	na	na	na	na	na
CPI for food (1982-84=100)	202.9	214.1	218.0	219.7	227.8f	5.5	1.8	0.8	3.7
Share of U.S. disposable income spent on food (%)	9.5	9.4	9.5	na	na	na	na	na	na
Share of total food expenditures for at-home consumption (%)	50.7	50.9	51.4	na	na	na	na	na	na
Farm-to-retail price spread (1982-84=100)	248.1	267.0	276.5	269.3	na	7.6	3.6	-2.6	na
Total USDA food and nutrition assistance spending (\$ bil.) <sup>2</sup>	54.3	60.9	79.2	95.4	na	12.2	30.0	20.5	na

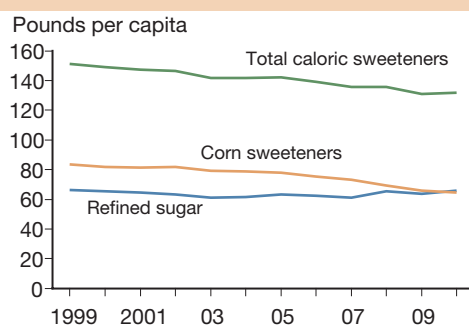
f = Forecast. p = Preliminary. na = Not available. All dollar amounts are in current dollars.

<sup>1</sup>The methodology for computing these measures has changed. These statistics are not comparable to previously published statistics.

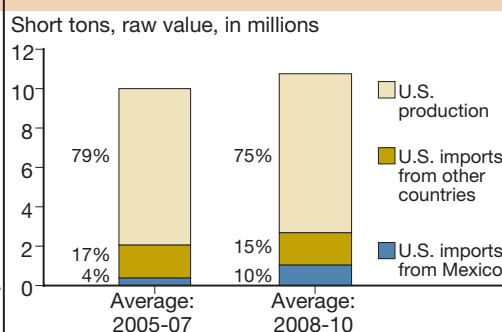
<sup>2</sup>Based on October-September fiscal years ending with year indicated.

Sources and computation methodology are available at: [www.ers.usda.gov/amberwaves/indicatorsnotes.htm](http://www.ers.usda.gov/amberwaves/indicatorsnotes.htm)

### U.S. per capita sweetener availability fell 19.4 pounds from 1999 to 2010



### After NAFTA, sugar imports from Mexico constituted a larger share of sugar consumed in the U.S.



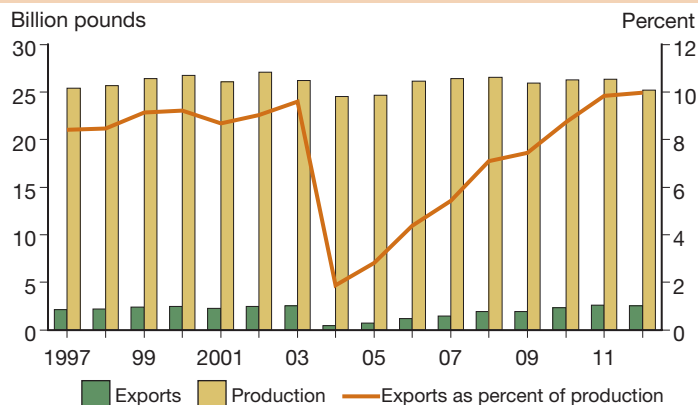
### The U.S. imports sugar from Mexico and exports corn sweeteners to Mexico



For more information, see [www.ers.usda.gov/amberwaves/](http://www.ers.usda.gov/amberwaves/)

## Markets and Trade

### U.S. beef production and exports

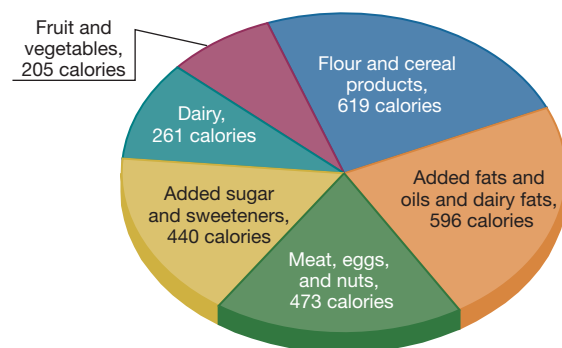


2011 and 2012 forecast.

Source: USDA, Economic Research Service.

## Diet and Health

### In 2009, flour and cereal products provided more daily calories for the average American than any other food group

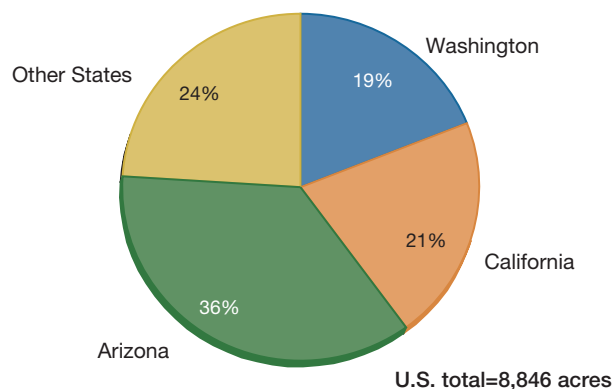


Note: Added fats and oils and added sugar and sweeteners are added to foods during processing or preparation.

Source: USDA, Economic Research Service, Loss-Adjusted Food Availability data.

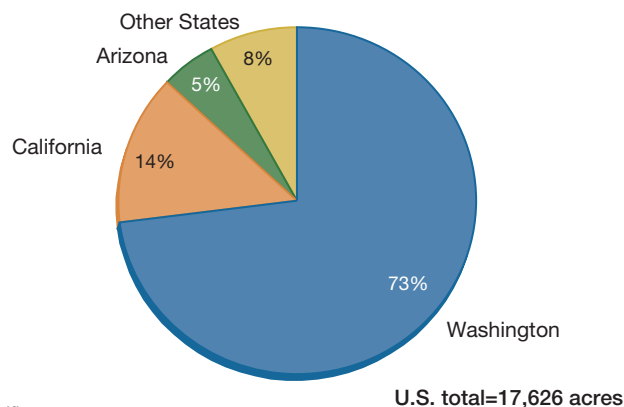
## Farms, Firms, and Households

### Arizona led in certified organic apple acres in the U.S. in 1997...



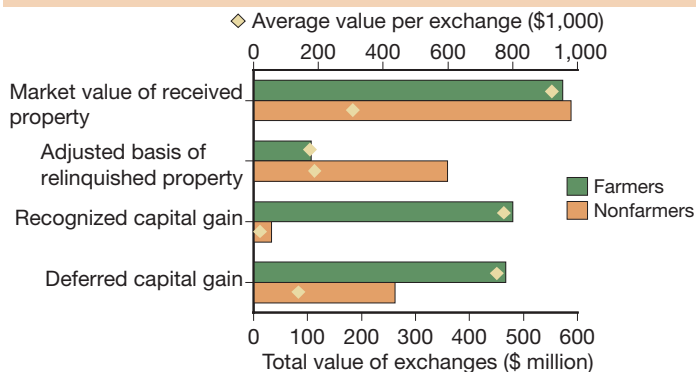
Source: USDA, Economic Research Service using information from U.S. State and private certifiers.

### ...but Washington ranked first in 2008



## Resources and Environment

### Active farmers conducted high-value tax deferred exchanges of farmland for farmland in 2005

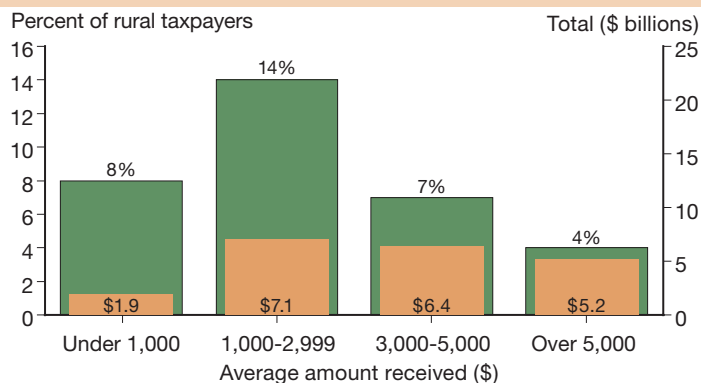


Note: Farmers made a total of 624 exchanges, nonfarmers made 1,938.

Source: USDA, Economic Research Service using Internal Revenue Service, Statistics of Income, Sales of Capital Assets data, 2005.

## Rural America

### About one-third of rural taxpayers received earned income or child tax credits in 2008



Source: USDA, Economic Research Service using 2008 Internal Revenue Service tax data.



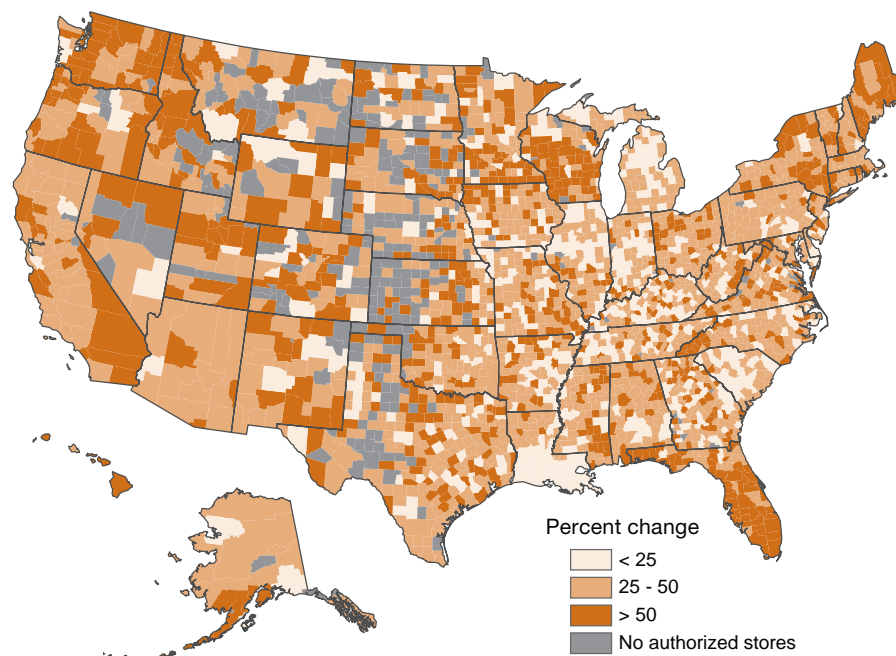
## On the Map

### SNAP Redemptions Per Store Grew Most in Nonmetro Counties

The economic hardships of the recent recession increased the number of Americans needing food assistance. The average number of participants in USDA's Supplemental Nutrition Assistance Program (SNAP, formerly known as the Food Stamp Program) grew from 28.2 million per month in 2008 to 33.5 million per month in 2009. Of the 2,887 U.S. counties with stores authorized to accept SNAP benefits in 2008-09, 1,391 counties experienced 25- to 50-percent increases in average redemptions per store. In another 813 counties, average per store SNAP redemptions rose more than 50 percent. Two-thirds of the 813 counties were nonmetro counties.

**Phil Kaufman,**  
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### Changes in SNAP redemptions per SNAP-authorized store, 2008-09



Source: USDA, Economic Research Service, Food Environment Atlas, [www.ers.usda.gov/foodatlas/](http://www.ers.usda.gov/foodatlas/)

## In the Long Run

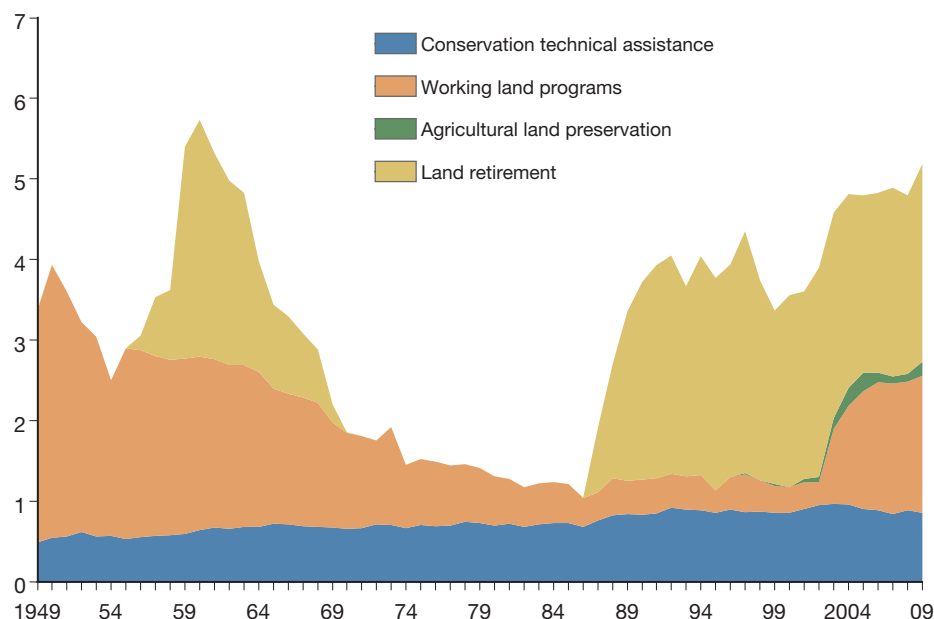
### USDA Conservation Spending on Working Agricultural Lands Bucks Long-Term Trend

USDA provides technical and financial assistance to help farmers implement conservation practices on working agricultural lands or on lands temporarily retired from production. As measured in constant (2009) dollars, Federal conservation assistance has fluctuated widely during the past 60 years. Rapid increases in spending have typically been associated with large-scale land retirement in the Soil Bank (1956-1972) and Conservation Reserve (1986-present) Programs. Since 2002, however, and after several decades with stable levels of spending, there has been a big increase in conservation assistance through programs that help farmers defray conservation costs on working agricultural lands.

**Roger Claassen,**  
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### USDA expenditures for major conservation programs

\$ billions (2009)



USDA, Economic Research Service using data from USDA's Natural Resources Conservation Service.